TOSHIBA

FILE NO. SVM-03021

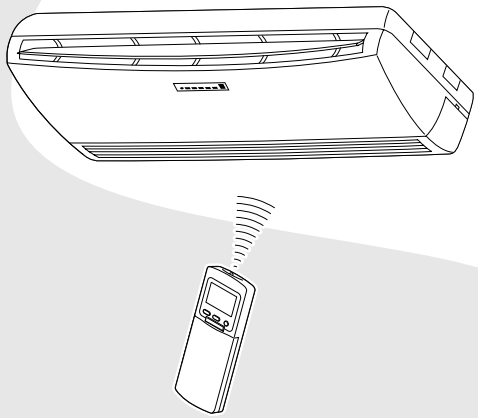
SERVICE MANUAL

AIR-CONDITIONER

UNDER CEILING / CONSOLE TYPE

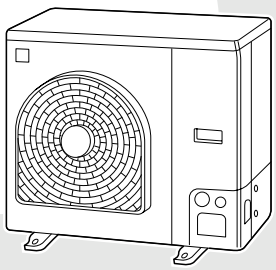
RAV-SM560XT-E / RAV-SM560AT-E

RAV-SM800XT-E / RAV-SM800AT-E



HFC

R410A



Sep., 2003

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1. SPECIFICATIONS

1-1. Indoor Unit

Model name				RAV-SM560XT-E			RAV-SM800XT-E		
				Cooling	Heating	Average	Cooling	Heating	Average
Standard capacity (Note 1)			kW	5.0 (1.5 – 5.6)	5.6 (1.5 – 6.3)		6.7 (2.2 – 8.0)	8.0 (2.2 – 9.0)	
Heating low temp. capacity (Note 1) (kW)				4.9			5.8		
Energy consumption effect ratio (Cooling)				2.67 [D]	3.29 [C]	2.98	2.46 [E]	3.00 [D]	2.73
Electrical characteristics	Power supply			1 phase 220 – 240V 50Hz					
	Running current		(A)	8.95 – 8.20	8.13 – 7.46		13.15 – 12.06	12.91 – 11.84	
	Power consumption		(kW)	1.87	1.7		2.72	2.67	
	(Low temp.)		(kW)	2.18			2.29		
	Power factor		(%)	95	95		94	94	
Appearance	Main unit			Pure white					
	Ceiling panel (Sold separately)	Model		——					
		Panel color		——					
Outer dimension	Main unit	Height	(mm)	633					
		Width	(mm)	1093					
		Depth	(mm)	208					
	Ceiling panel (Sold separately)	Height	(mm)	——					
		Width	(mm)	——					
		Depth	(mm)	——					
Total weight	Main unit		(kg)	23					
	Ceiling panel			——					
Heat exchanger				Finned tube					
Fan unit	Fan			Multi blade fan					
	Standard air flow High (Mid./Low)		(m^3/h)	800 (680/580)			900(750/550)		
	Motor		(W)	50					
Air filter				Washable filter					
Controller (Sold separately)				Wireless remote control					
Dimensions pipe	Gas side		(mm)	∅12.7 (1/2")			∅15.9 (5/8")		
	Liquid side		(mm)	∅6.4 (1/4")			∅9.5 (3/8")		
	Drain port		(Nominal dia.)	25 (Polyvinyl chloride tube)					
Sound level	High (Mid./Low) (Note 2)		(dB•A)	43	39	36	46	42	37

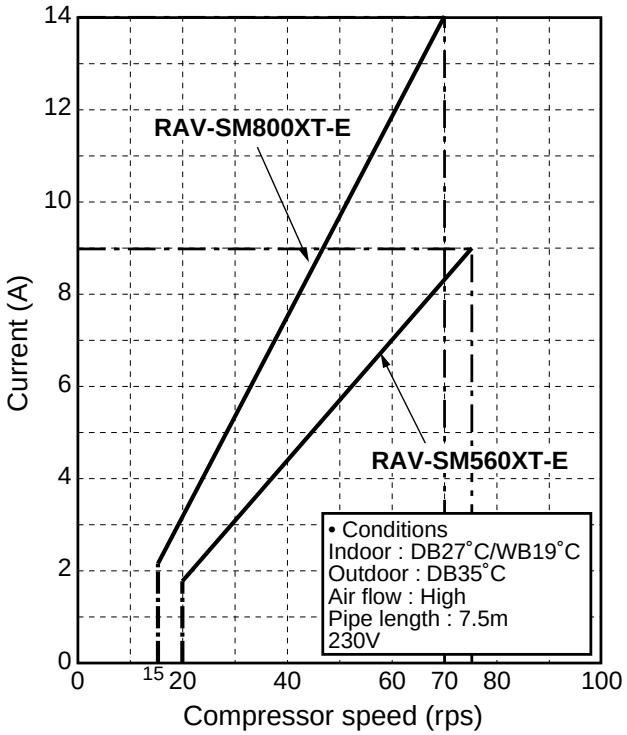
Note 1 : The cooling capacities and electrical characteristics are measured under the conditions specified by JIS B 8616 based on the reference piping length 7.5 m with 0 meter height.

Note 2 : The sound level is measured in an anechoic chamber in accordance with JIS B8616. Normally, the values measured in the actual operating environment become larger than the indicated values due to the effects of external sound.

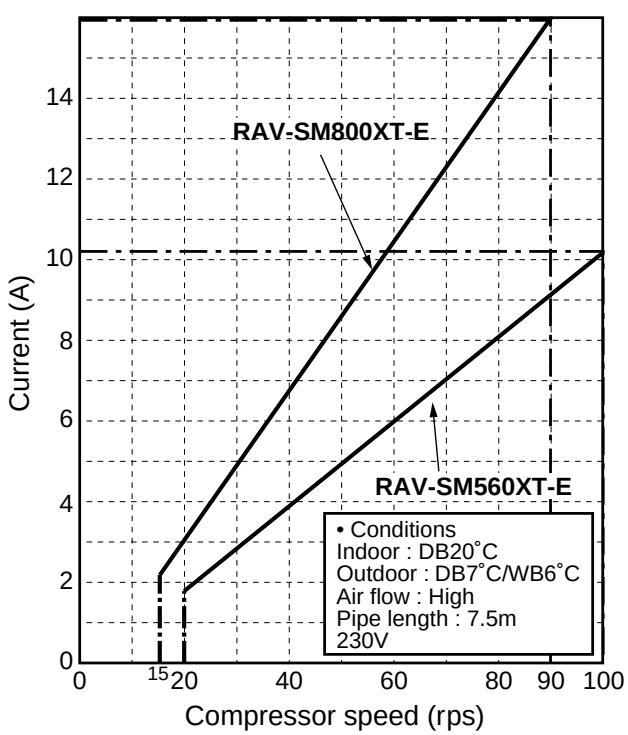
Note : Rated conditions Cooling : Indoor air temperature 27°C DB/19°C WB, Outdoor air temperature 35°C DB
Heating : Indoor air temperature 20°C DB, Outdoor air temperature 7°C DB/6°C WB

• **Operation characteristic curve**

<Cooling>

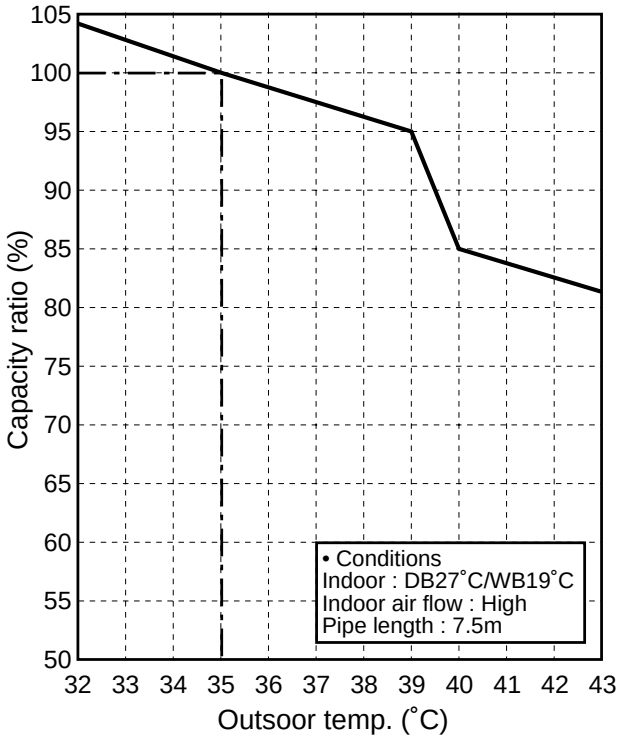


<Heating>



• **Capacity variation ratio according to temperature**

<Cooling>



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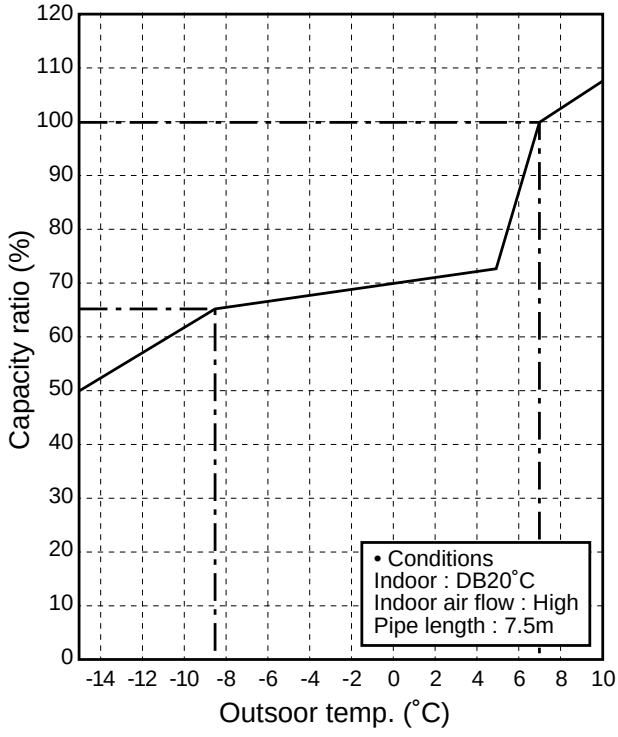


1-2. Outdoor Unit

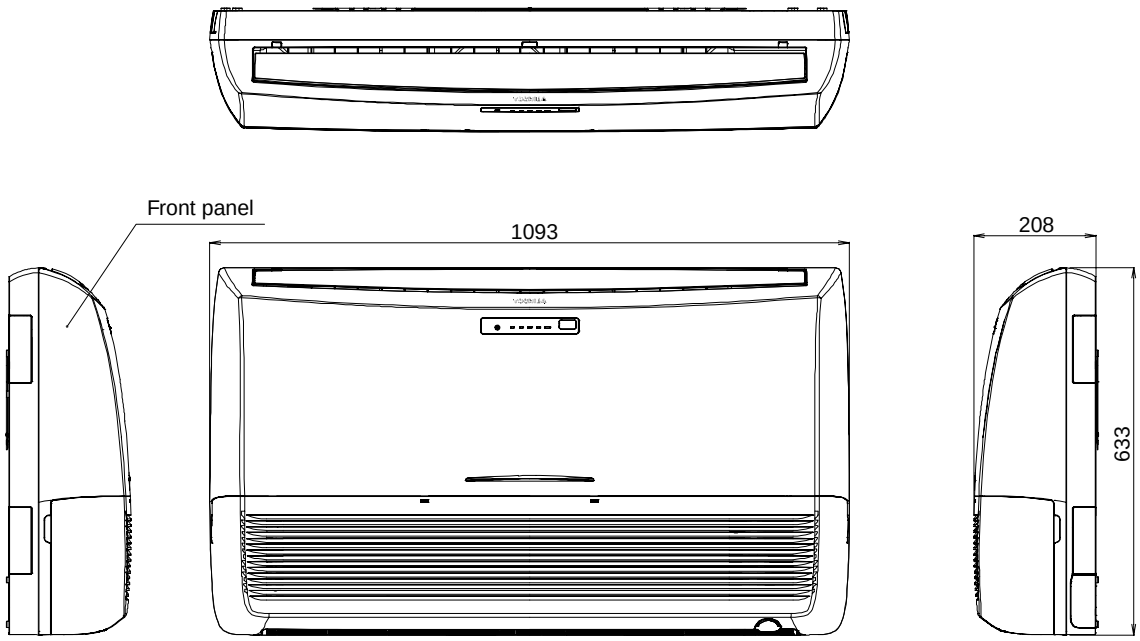
Model name				RAV-SM560AT-E	RAV-SM800AT-E
Appearance				Silky shade (Muncel 1Y8.5/0.5)	
Power supply				1 phase 230V (220 – 240V) 50Hz (Power exclusive to outdoor is required.)	
Compressor	Type			Hermetic compressor	
	Motor		(kW)	1.1	1.6
	Pole			4 poles	
Refrigerant charged			(kg)	R410A 0.9	R410A 1.5
Refrigerant control				Pulse motor valve	
Pipe	Standard length			20 (without additional charge)	
	Max. total length		(m)	30	50
	Over 20m			Add 20g/m (Max. 200g)	Add 40g/m (Max. 1200g)
	Height difference	Outdoor lower	(m)	15	
		Outdoor higher	(m)	30	
Outer dimension	Height		(mm)	595	795
	Width		(mm)	780	780
	Depth		(mm)	270	270
Total weight			(kg)	35	55
Heat exchanger				Finned tube	
Fan unit	Fan			Propeller fan	
	Standard air flow High		(m^3/h)	2400	3400
	Motor		(W)	43	63
Connecting pipe	Gas side		(mm)	Ø12.7 (1/2”)	Ø15.9 (5/8”)
	Liquid side		(mm)	Ø6.4 (1/4”)	Ø9.5 (3/8”)
Protection device				Discharge temp. sensor Over-current sensor Compressor thermo.	
Sound level (Note 2)	High (Mid./Low) (Cooling/Heating)		(dB•A)	46/48	48/50

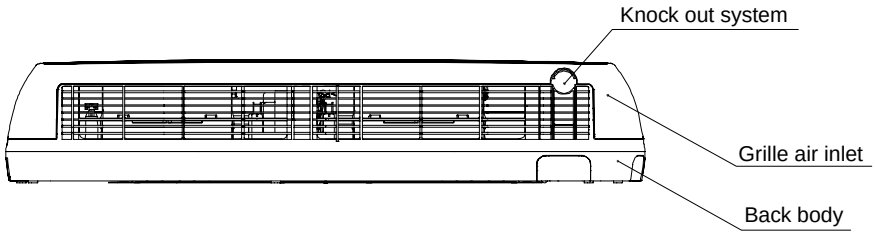
Note 1 : The sound level is measured in an anechoic chamber in accordance with JIS B8616. Normally, the values measured in the actual operating environment become larger than the indicated values due to the effects of external sound.

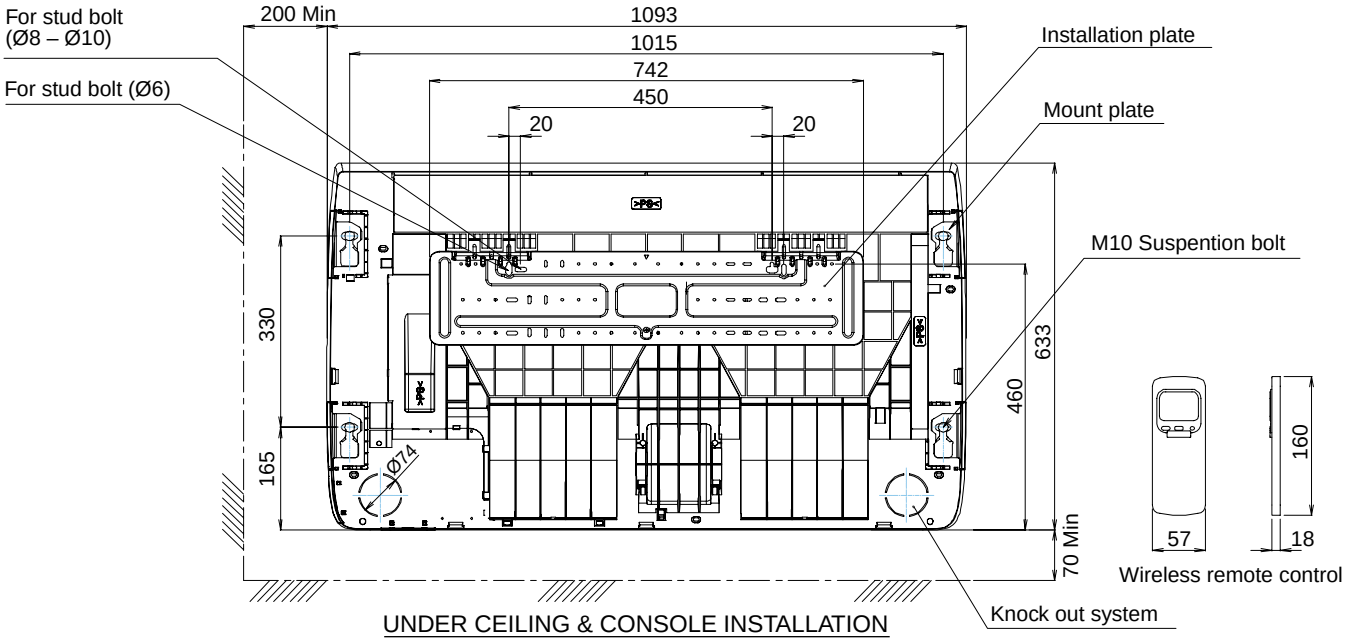
Note 2 : Rated conditions Cooling : Indoor air temperature 27°C DB/19°C WB, Outdoor air temperature 35°C DB
Heating : Indoor air temperature 20°C DB, Outdoor air temperature 7°C DB/6°C WB

2. CONSTRUCTION VIEWS

2-1. Indoor Unit

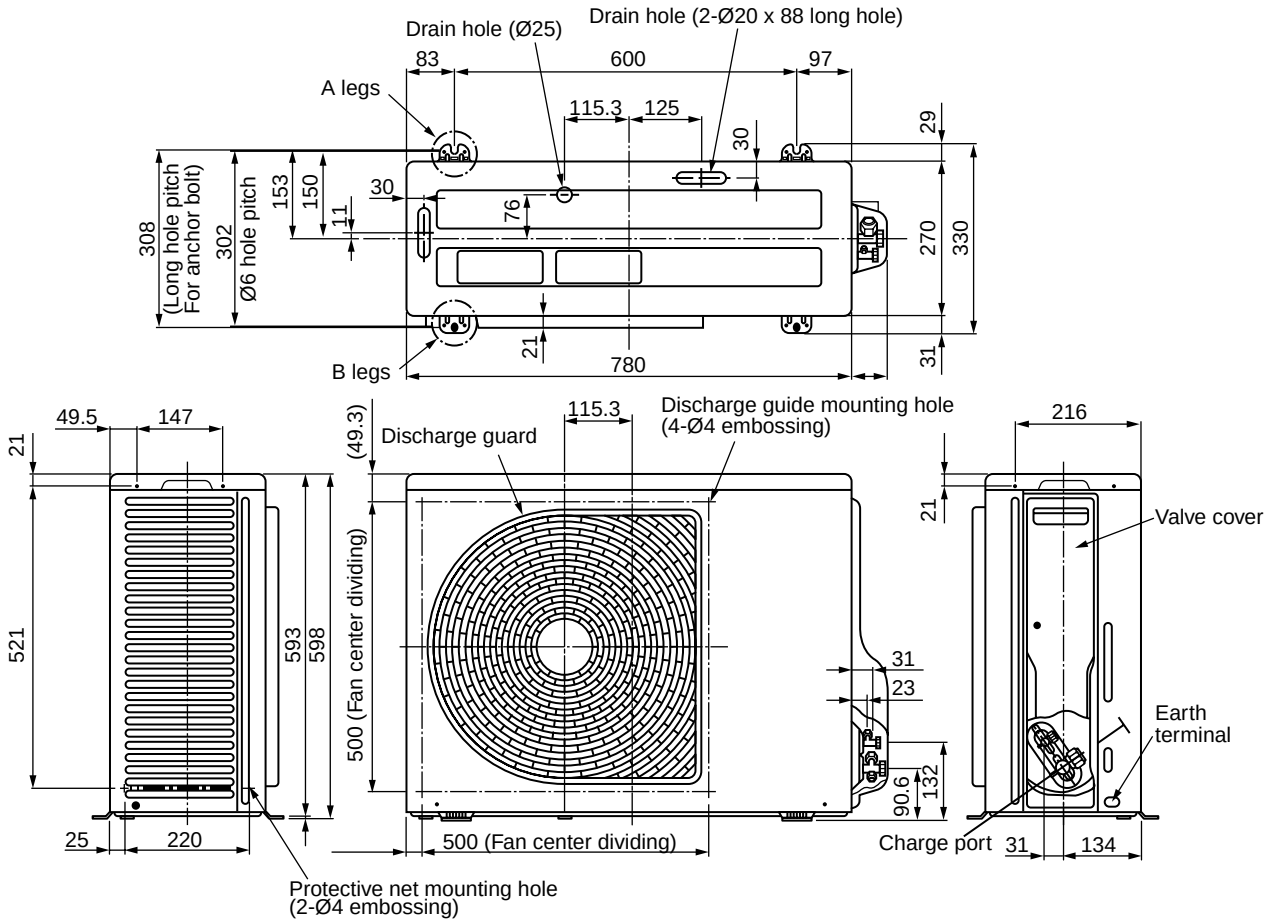


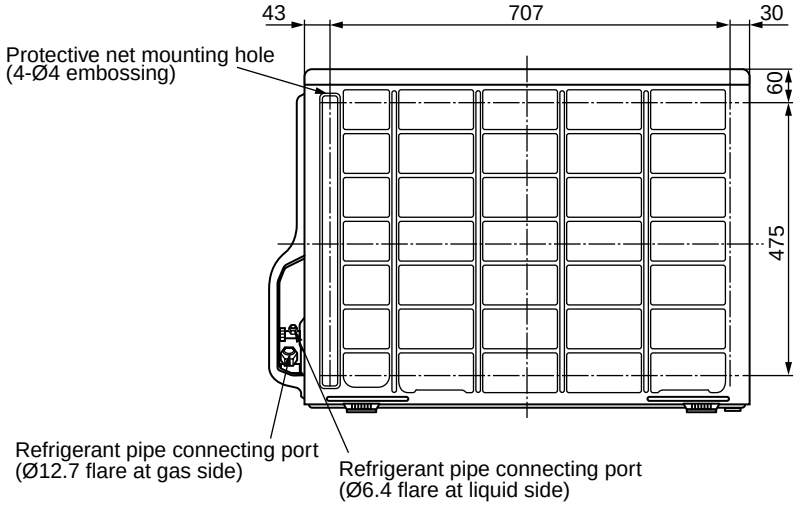




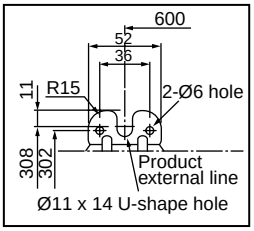
UNDER CEILING & CONSOLE INSTALLATION

2-2. Outdoor Unit (RAV-SM560AT-E)

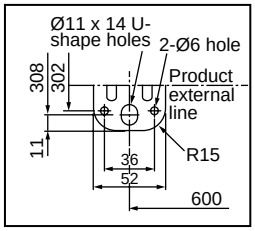




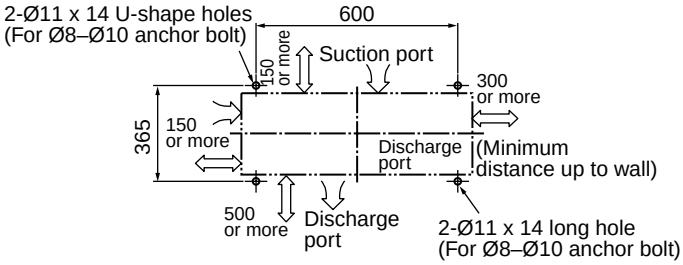
Space required for service



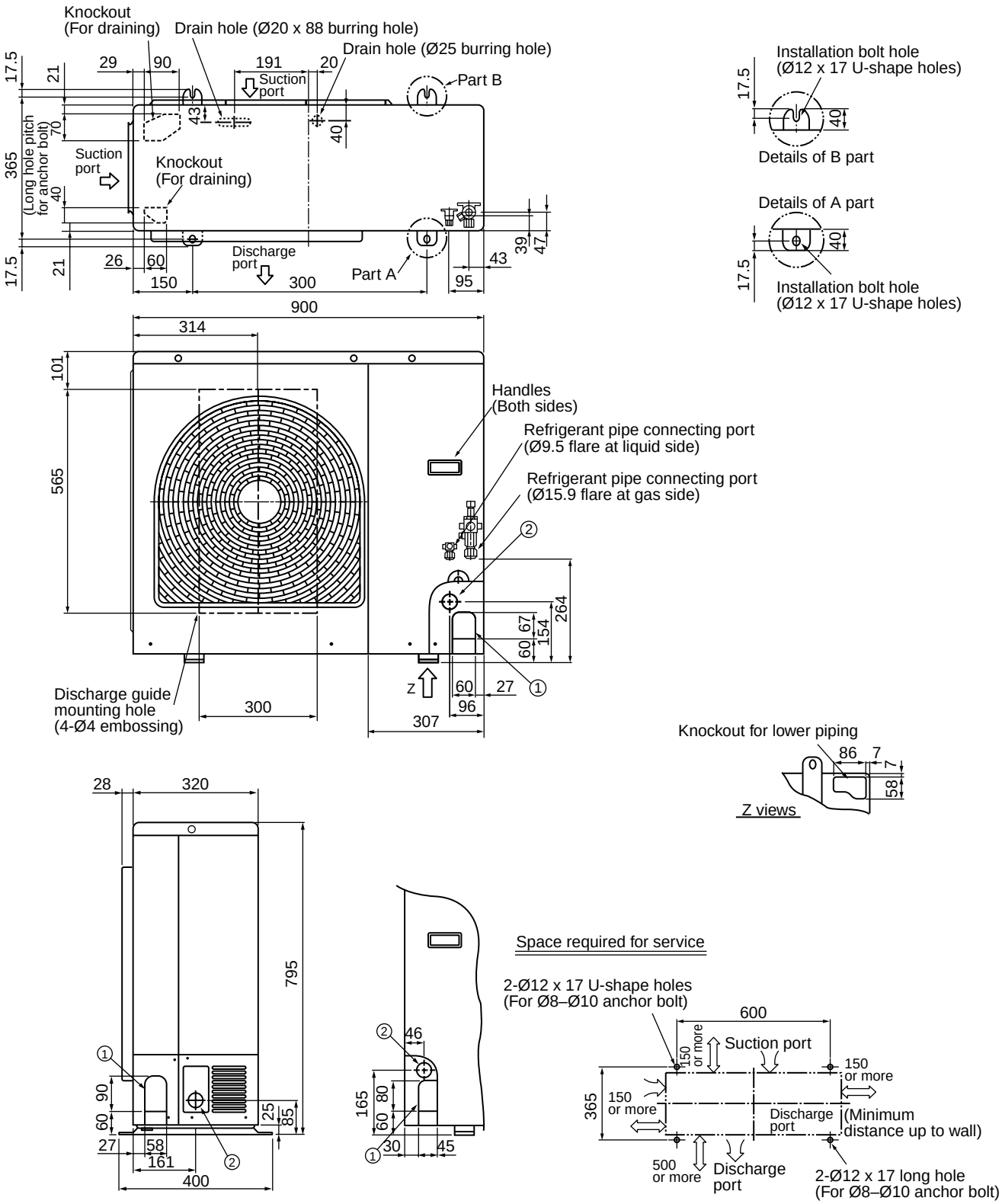
Details of A legs



Details of B legs

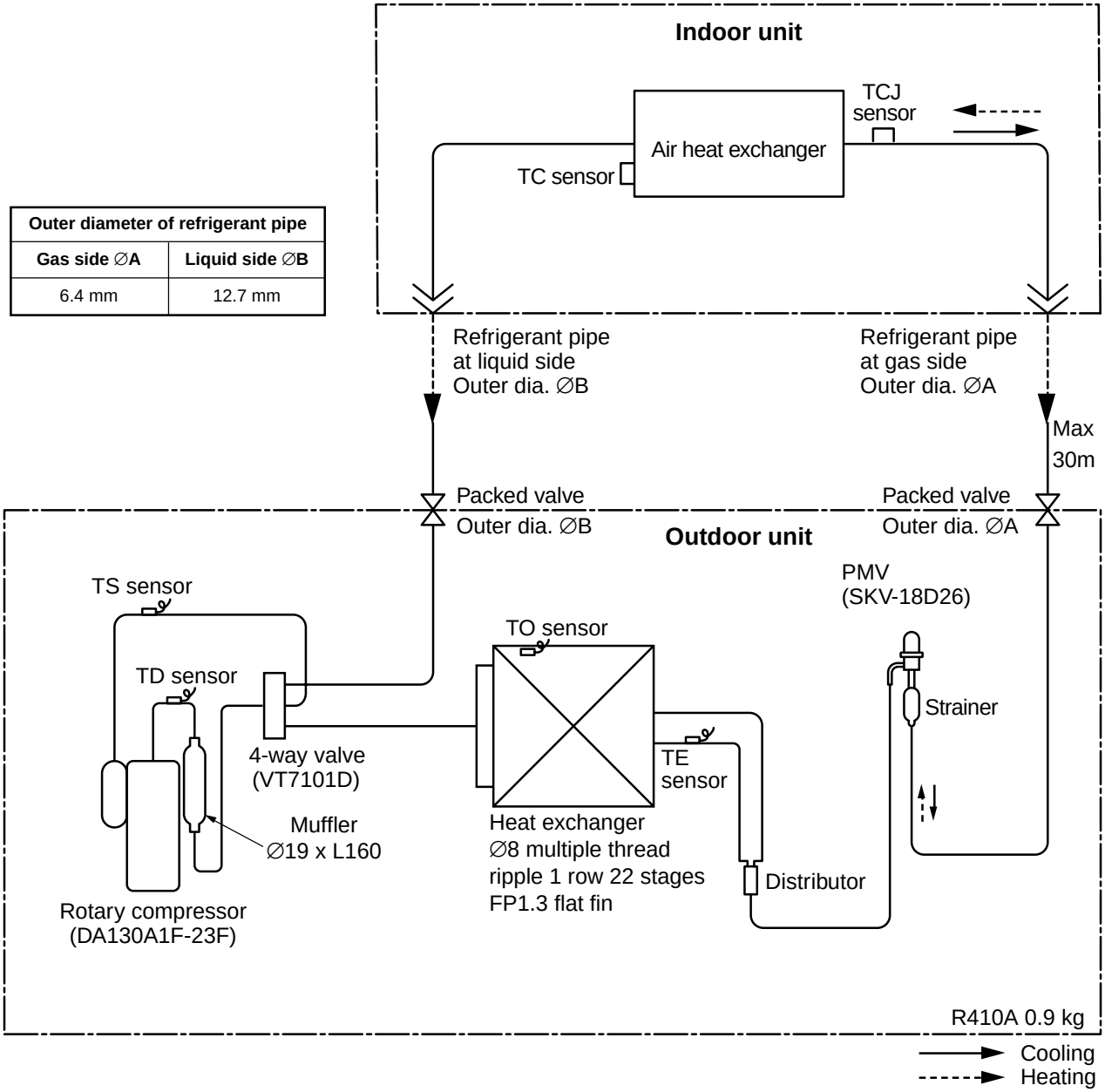


2-3. Outdoor Unit (RAV-SM800AT-E)



3. SYSTEMATIC REFRIGERATING CYCLE DIAGRAM

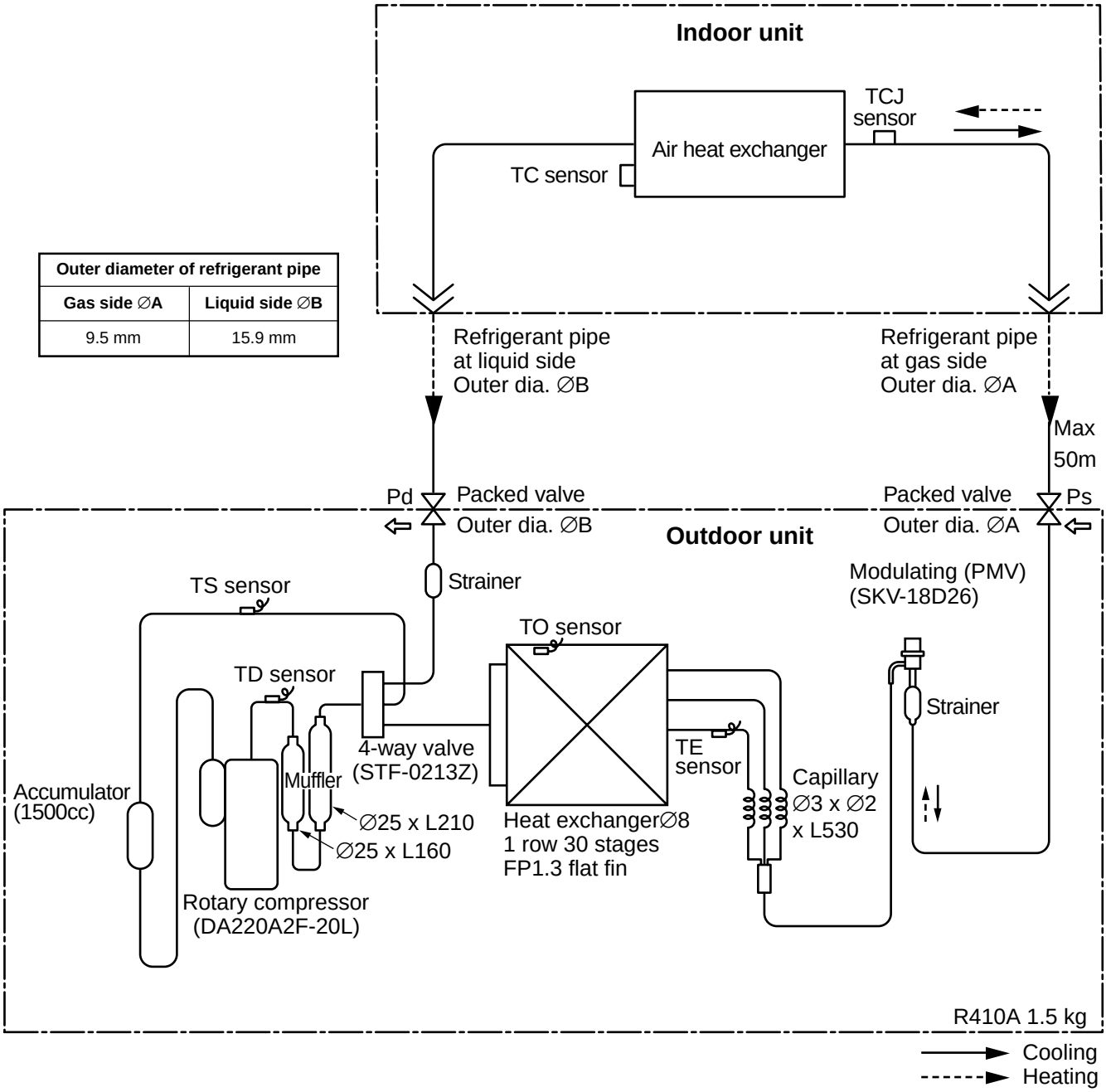
3-1. RAV-SM560XT-E / RAV-SM560AT-E



		Pressure (MPa)		Pipe surface temperature (°C)				Compressor revolutions per second (rps) *	Indoor fan	Indoor/Outdoor temp. conditions (DB/WB) (°C)	
		Pd	Ps	Discharge (TD)	Suction (TS)	Indoor heat exchanger (TC)	Outdoor heat exchanger (TE)			Indoor	Outdoor
Cooling	Standard	3.1	0.9	85	13	10	47	74	HIGH	27/19	35/–
	Overload	3.8	1.0	96	13	12	60	71	HIGH	32/24	43/–
	Low load	0.9	0.5	25	7	10	5	28	LOW	18/15.5	–5/–
Heating	Standard	2.8	0.6	87	3	46	1	87	HIGH	20/–	7/6
	Overload	3.3	1.1	78	22	55	16	55	LOW	30.–	24/18
	Low load	1.7	0.2	110	–20	26	–22	110	HIGH	0	–20/(70%)

* 4 poles are provided to this compressor.
The compressor frequency (Hz) measured with a clamp meter is 2 times of revolutions (rps) of the compressor.

3-2. RAV-SM800XT-E / RAV-SM800AT-E



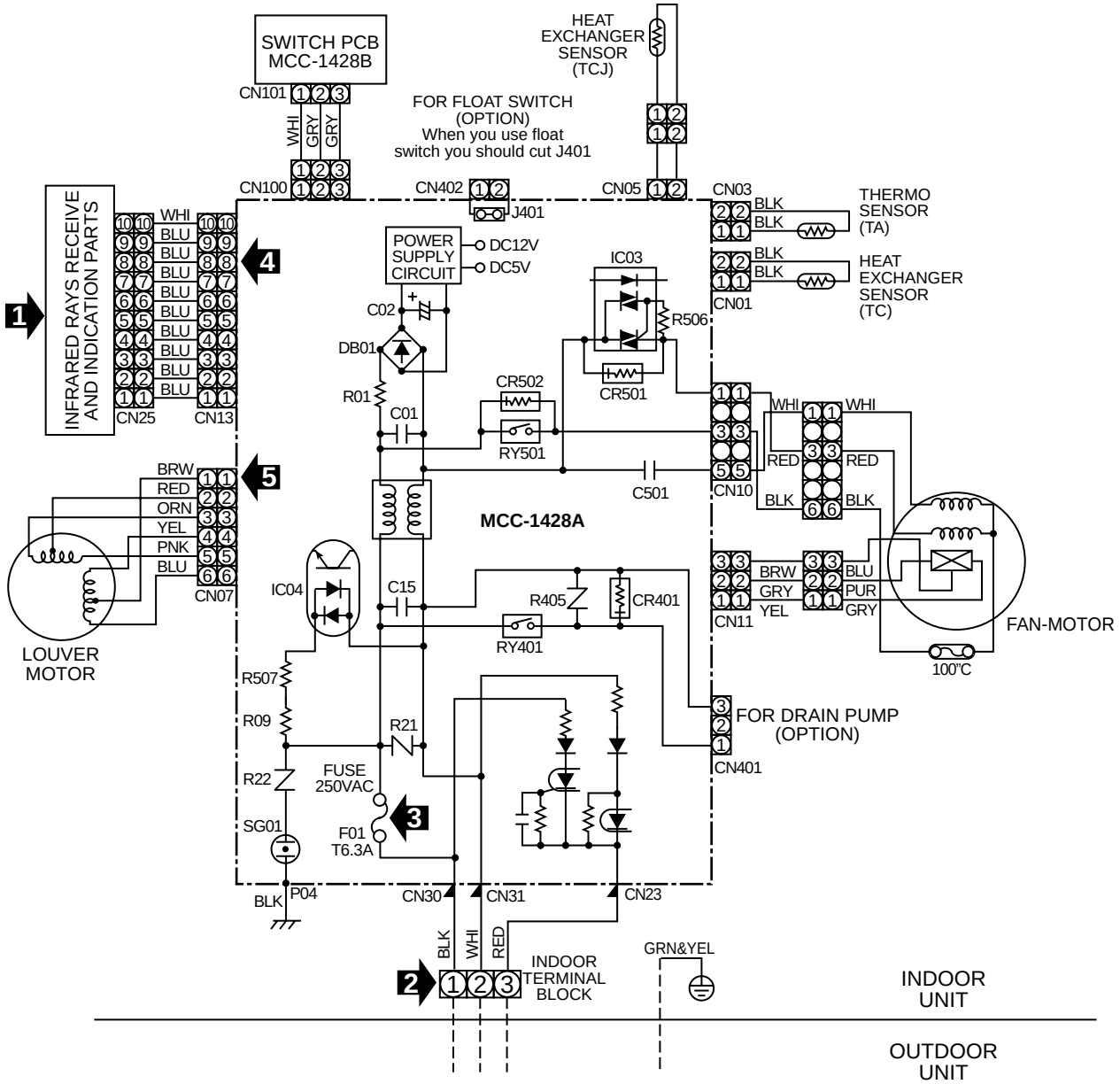
Outer diameter of refrigerant pipe	
Gas side ∅A	**Liquid side ∅B**
9.5 mm	15.9 mm

		Pressure (MPa)		Pipe surface temperature (°C) Discharge (TD)	Suction (TS)	Indoor heat exchanger (TC)	Outdoor heat exchanger (TE)	Compressor revolutions per second (rps) *	Indoor fan	Indoor/Outdoor temp. conditions (DB/WB) (°C)	
		Pd	Ps							Indoor	Outdoor
Cooling	Standard	3.3	0.9	89	8	8	40	64	HIGH	27/19	35/–
	Overload	3.7	1.1	87	17	14	46	45	HIGH	32/24	43/–
	Low load	1.0	0.8	22	2	1	1	24	LOW	18/15.5	–5/–
Heating	Standard	3.3	0.6	93	0	54	0	70	HIGH	20/–	7/6
	Overload	3.1	1.1	75	20	52	15	24	LOW	30.–	24/18
	Low load	2.0	0.2	90	–26	25	–25	90	HIGH	0	–20/(70%)

* 4 poles are provided to this compressor.
The compressor frequency (Hz) measured with a clamp meter is 2 times of revolutions (rps) of the compressor.

4. WIRING DIAGRAM

4-1. Indoor Unit



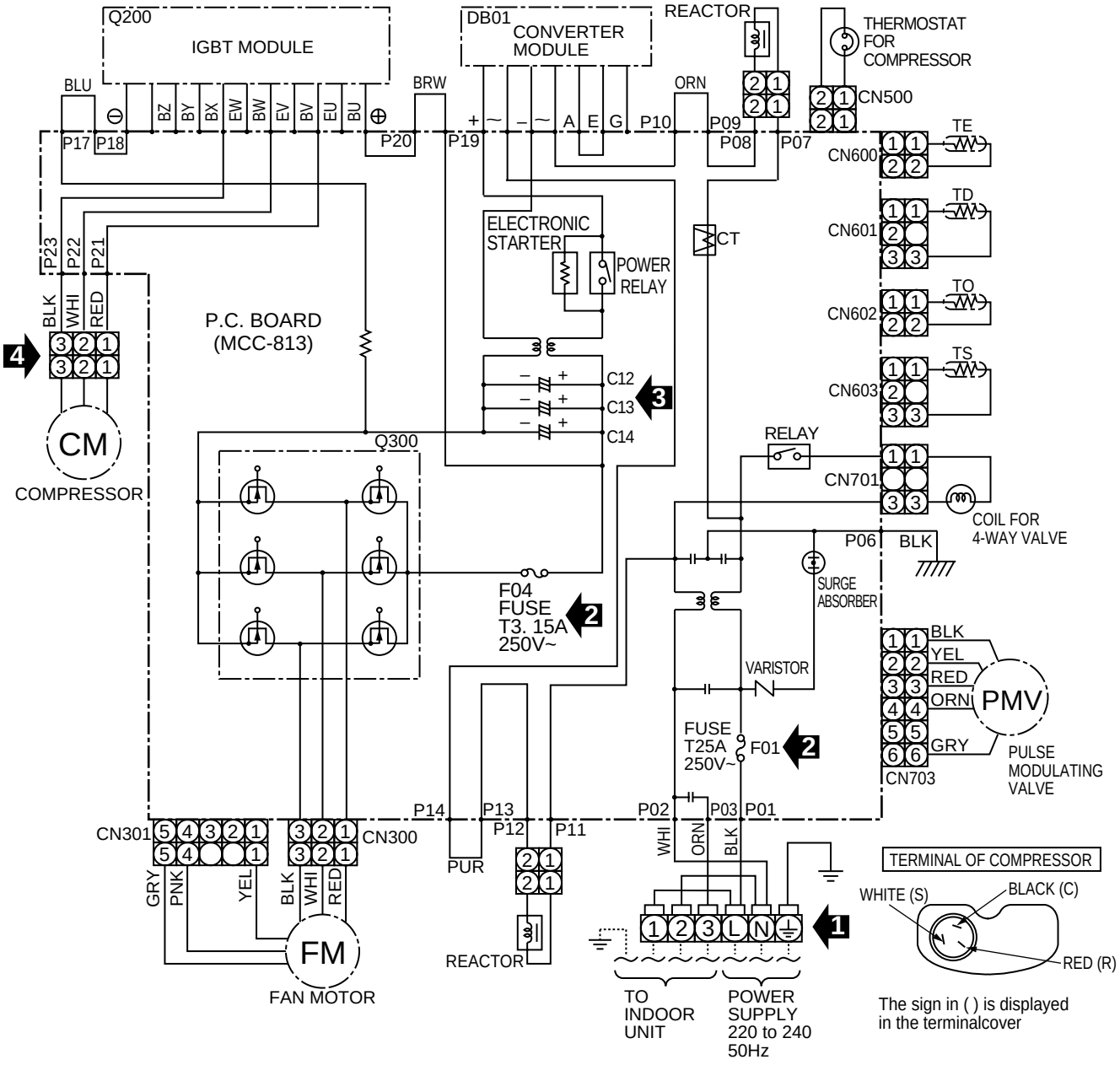
SIMPLE CHECK POINTS FOR DIAGNOSING FAULTS

Check items	Diagnosis result
1 OPERATION indicator	Check to see if OPERATION indicator goes on and off when the main switch or breaker is turned on.
2 Terminal block	Check the power supply voltage between ① - ② (Refer to the name plate.) Chack the fluctuate voltage between ② - ③ (DC15 to 60V)
3 Fuse 6.3A	Check to see if the fuse blows out. (Check the varistor. : R22, R21)
4 DC 5V	Check the voltage at the No.8 pin on CN13 connector of the infrared receiver. (Check the transformer and the power supply circuit of the rated voltage.)
5 DC 12V	Check the voltage at the brown lead of the louver motor. (Check the transformer and the power supply circuit of the rated voltage.)

Color Identification

BRW	: BROWN
RED	: RED
WHI	: WHITE
YEL	: YELLOW
BLU	: BLUE
BLK	: BLACK
GRY	: GRAY
PNK	: PINK
ORN	: ORANGE
GRN&YEL	: GREEN& YELLOW
GRN	: GREEN
PUR	: PURPLE

4-2. Outdoor Unit (RAV-SM560AT-E)



SIMPLE CHECK POINTS FOR DIAGNOSING FAULTS

Check items	Diagnosis result
1	TERMINAL BLOCK There is no supply voltage (AC220 to 240V) between Ⓛ - Ⓝ , ① - ② There is no voltage (DC15 to 25V) ② - ③ → Power supply and connecting cable check
2	FUSE T25A 250V to fuse (F01) blown T3.15A 250V to fuse (F04) blown → Converter module (DB01) and electrolytic capacitor (C12 to C14) check IGBT module (Q200) check Fan motor check
3	ELECTROLYTIC CAPACITOR VOLTAGE (C12, C13, C14) DC320V not available between ⊕⊖ terminal of electrolytic capacitor → T25A fuse (F01) check P.C. board and converter module (DB01) check
4	INVERTER OUTPUT (Inverter and compressor connector out of position) (Please confirm within six minutes after instructing in the drive.) Voltage between each line of inverter side conector pins are not equal. → IGBT module and P.C. board check

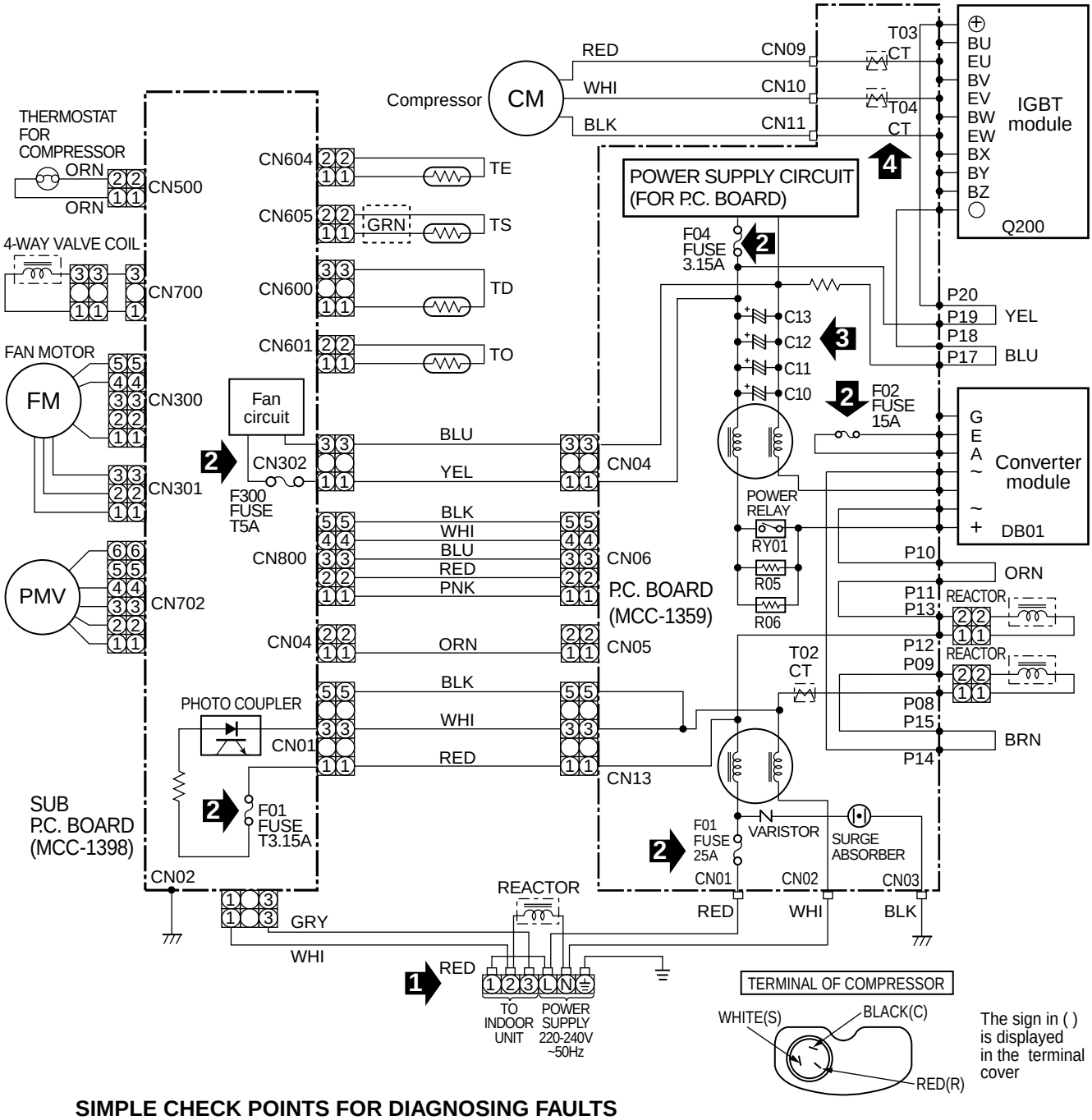
Color Identification

BLK	: BLACK	WHI	: WHITE
BLU	: BLUE	BRW	: BROWN
RED	: RED	ORN	: ORANGE
GRY	: GRAY	YEL	: YELLOW
PNK	: PINK	PUR	: PURPLE
GRN	: GREEN		

NOTE

CM	: Compressor
PMV	: Pulse modulating valve
FM	: Fan motor
TE	: Heat exchanger Temp. Sensor
TD	: Discharge Temp. Sensor
TO	: Outdoor Temp. Sensor
TS	: Suction Temp. Sensor
IGBT	: Insulated Gate Bipolar Transistor
DB01	: Converter module
CT	: Curreut Transformer
Q300	: Fan motor driver module

4-3. Outdoor Unit (RAV-SM800AT-E)



SIMPLE CHECK POINTS FOR DIAGNOSING FAULTS

Check items	Diagnosis result
1	TERMINAL BLOCK There is no supply voltage (AC220 to 240V) between Ⓛ - Ⓝ , ① - ② There is no voltage (DC15 to 25V) ② - ③ → Connecting cable check
2	FUSE 25A fuse (F01) blown, 15A fuse (F02) blown 3.15A fuse (F04) blown, T5A fuse (F300) blown (SUB P.C. board) T3.15A fuse (F01) blown (SUB P.C. board) → Converter module (DB01) and electrolytic capacitor (C10 to C13) check IGBT module (Q200) check, Fan motor check SUB P.C. board check
3	ELECTROLYTIC CAPACITOR VOLTAGE (C10, C11, C12, C13) DC320V not available between ⊕○terminal of electrolytic capacitor → 25A fuse (F01) check P.C. board and coverter module (DB01) check
4	INVERTER OUTPUT (CN09, CN10, CN11) (Please confirm within six minutes after instructing in the drive.) Voltage between each line of inverterside conector pins are not equal. → IGBT module and P.C. board check

Color Identification

BLK	: BLACK	WHI	: WHITE
BLU	: BLUE	BRN	: BROWN
RED	: RED	ORN	: ORANGE
GRY	: GRAY	YEL	: YELLOW
PNK	: PINK	PUR	: PURPLE
GRN	: GREEN		

5. SPECIFICATION OF ELECTRICAL PARTS

5-1. Indoor Unit

No.	Parts name	Type	Specifications
1	Fan motor (for indoor)	AFP-220-50-4A	Output (Rated) 50 W, 220 – 240 V
2	Grille motor	MP35EA12	DC 12 V
3	Thermo. sensor (TA-sensor)	550 mm	10 kΩ at 25°C
4	Heat exchanger sensor (TC-sensor)	∅6 mm, 500 mm	10 kΩ at 25°C
5	Heat exchanger sensor (TCJ-sensor)	∅6 mm, 500 mm	10 kΩ at 25°C

5-2. Outdoor Unit (RAV-SM560AT-E)

No.	Parts name	Type	Specifications
1	Fan motor	ICF-140-43-1	Output (Rated) 40 W
2	Compressor	DA130A1F-23F	3 phase, 4P, 1100 W
3	Reactor	CH-57	1=10 mH, 16A
4	Outdoor temp. sensor (To-sensor)	—	10 kΩ at 25°C
5	Heat exchanger sensor (Te-sensor)	—	10 kΩ at 25°C
6	Suction temp. sensor (Ts-sensor)	—	10 kΩ at 25°C
7	Discharge temp. sensor (Td-sensor)	—	50 kΩ at 25°C
8	Fuse (Switching power (Protect))	—	T3.15 A, AC 250 V
9	Fuse (Inverter, input (Current protect)	—	25 A, AC 250 V
10	4-way valve solenoid coil	STF-0108G	
11	Compressor thermo. (Protection)	US-622	ON : 90 ± 5°C, OFF : 125 ± 4°C

5-3. Outdoor Unit (RAV-SM800AT-E)

No.	Parts name	Type	Specifications
1	Fan motor	ICF-140-63-1	Output (Rated) 63 W, 220 – 240 V
2	Compressor	DA220A2F-20L	3 phase, 4P, 1600 W
3	Reactor	CH-47	
4	Outdoor temp. sensor (To-sensor)	—	10 kΩ at 25°C
5	Heat exchanger sensor (Te-sensor)	—	10 kΩ at 25°C
6	Suction temp. sensor (Ts-sensor)	—	10 kΩ at 25°C
7	Discharge temp. sensor (Td-sensor)	—	50 kΩ at 25°C
8	Fuse (Switching power (Protect))	—	T3.15 A, AC 250 V
9	Fuse (Inverter, input (Current protect)	—	25 A, AC 250 V
10	4-way valve solenoid coil	DKV-M0ZS743B0	
11	Compressor thermo. (Protection)	US-622	ON : 90 ± 5°C, OFF : 125 ± 4°C

6. REFRIGERANT R410A

This air conditioner adopts the new refrigerant HFC (R410A) which does not damage the ozone layer.

The working pressure of the new refrigerant R410A is 1.6 times higher than conventional refrigerant (R22). The refrigerating oil is also changed in accordance with change of refrigerant, so be careful that water, dust, and existing refrigerant or refrigerating oil are not entered in the refrigerant cycle of the air conditioner using the new refrigerant during installation work or servicing time.

The next section describes the precautions for air conditioner using the new refrigerant. Conforming to contents of the next section together with the general cautions included in this manual, perform the correct and safe work.

6-1. Safety During Installation/Servicing

As R410A's pressure is about 1.6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration.

(1) Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A.
If other refrigerant than R410A is mixed, pressure in the refrigeration cycle becomes abnormally high, and it may cause personal injury, etc. by a rupture.

(2) Confirm the used refrigerant name, and use tools and materials exclusive for the refrigerant R410A. The refrigerant name R410A is indicated on the visible place of the outdoor unit of the air conditioner using R410A as refrigerant. To prevent mischarging, the diameter of the service port differs from that of R22

(3) If a refrigeration gas leakage occurs during installation/servicing, be sure to ventilate fully.
If the refrigerant gas comes into contact with fire, a poisonous gas may occur.

(4) When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture of personal injury may be caused.

(5) After completion of installation work, check to make sure that there is no refrigeration gas leakage.
If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc., a poisonous gas may occur.

(6) When an air conditioning system charged with a large volume of refrigerant is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level.
If the refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result.

(7) Be sure to carry out installation or removal according to the installation manual.
Improper installation may cause refrigeration trouble, water leakage, electric shock, fire, etc.

(8) Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician.
Improper repair's may result in water leakage, electric shock and fire, etc.

6-2. Refrigerant Piping Installation

6-2-1. Piping materials and joints used

For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants.

(1) Copper pipes
It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10 m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface). Otherwise, the expansion valve or capillary tube may become blocked with contaminants.
As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.
Thicknesses of copper pipes used with R410A are as shown in Table 6-2-1. Never use copper pipes thinner than 0.8 mm even when it is available on the market.

Table 6-2-1 Thicknesses of annealed copper pipes

		Thickness (mm)	
Nominal diameter	**Outer diameter (mm)**	**R410A**	**R22**
1/4	6.35	0.80	0.80
3/8	9.52	0.80	0.80
1/2	12.70	0.80	0.80
5/8	15.88	1.00	1.00

(2) Joints
For copper pipes, flare joints or socket joints are used. Prior to use, be sure to remove all contaminants.

a) Flare joints
Flare joints used to connect the copper pipes cannot be used for pipings whose outer diameter exceeds 20 mm. In such a case, socket joints can be used.
Sizes of flare pipe ends, flare joint ends and flare nuts are as shown in Tables 6-2-3 to 6-2-6 below.

b) Socket joints
Socket joints are such that they are brazed for connections, and used mainly for thick pipings whose diameter is larger than 20 mm.
Thicknesses of socket joints are as shown in Table 6-2-2.

Table 6-2-2 Minimum thicknesses of socket joints

Nominal diameter	**Reference outer diameter of copper pipe jointed (mm)**	**Minimum joint thickness (mm)**
1/4	6.35	0.50
3/8	9.52	0.60
1/2	12.70	0.70
5/8	15.88	0.80

6-2-1. Processing of piping materials

When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil other than lubricating oils used in the installed air conditioner is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed. When stored, be sure to seal the container with an airtight cap or any other cover.

(1) Flare Processing procedures and precautions

a) Cutting the pipe
By means of a pipe cutter, slowly cut the pipe so that it is not deformed.

b) Removing burrs and chips
If the flared section has chips or burrs, refrigerant leakage may occur. Carefully remove all burrs and clean the cut surface before installation.

c) Insertion of flare nut

d) Flare processing
Make certain that a clamp bar and copper pipe have been cleaned.
By means of the clamp bar, perform the flare processing correctly.
Use either a flare tool for R410A or conventional flare tool.
Flare processing dimensions differ according to the type of flare tool. When using a conventional flare tool, be sure to secure “dimension A” by using a gauge for size adjustment.

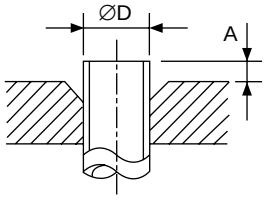


Fig. 6-2-1 Flare processing dimensions

Table 6-2-3 Dimensions related to flare processing for R410A

Nominal diameter	Outer diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 to 0.5	1.0 to 1.5	1.5 to 2.0
3/8	9.52	0.8	0 to 0.5	1.0 to 1.5	1.5 to 2.0
1/2	12.70	0.8	0 to 0.5	1.0 to 1.5	2.0 to 2.5
5/8	15.88	1.0	0 to 0.5	1.0 to 1.5	2.0 to 2.5

Table 6-2-4 Dimensions related to flare processing for R22

Nominal diameter	Outer diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool for R22 clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 to 0.5	0.5 to 1.0	1.0 to 1.5
3/8	9.52	0.8	0 to 0.5	0.5 to 1.0	1.0 to 1.5
1/2	12.70	0.8	0 to 0.5	0.5 to 1.0	1.5 to 2.0
5/8	15.88	1.0	0 to 0.5	0.5 to 1.0	1.5 to 2.0

Table 6-2-5 Flare and flare nut dimensions for R410A

Nominal diameter	Outer diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
1/4	6.35	0.8	9.1	9.2	6.5	13	17
3/8	9.52	0.8	13.2	13.5	9.7	20	22
1/2	12.70	0.8	16.6	16.0	12.9	23	26
5/8	15.88	1.0	19.7	19.0	16.0	25	29

Table 6-2-6 Flare and flare nut dimensions for R22

Nominal diameter	Outer diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
1/4	6.35	0.8	9.0	9.2	6.5	13	17
3/8	9.52	0.8	13.0	13.5	9.7	20	22
1/2	12.70	0.8	16.2	16.0	12.9	20	24
5/8	15.88	1.0	19.4	19.0	16.0	23	27
3/4	19.05	1.0	23.3	24.0	19.2	34	36

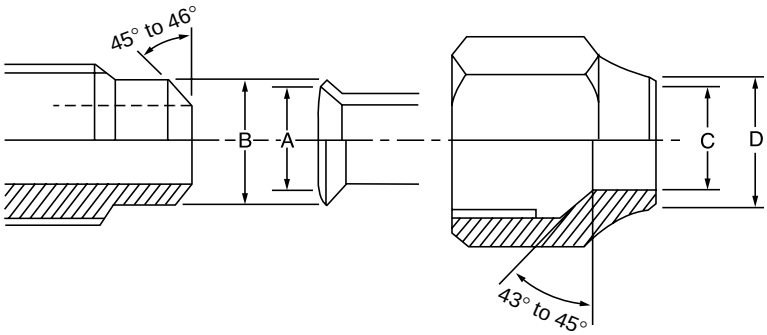


Fig. 6-2-2 Relations between flare nut and flare seal surface

(2) Flare connecting procedures and precautions

a) Make sure that the flare and union portions do not have any scar or dust, etc.

b) Correctly align the processed flare surface with the union axis.

c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for conventional R22. Incidentally, when the torque is weak, the gas leakage may occur. When it is strong, the flare nut may crack and may be made non-removable. When choosing the tightening torque, comply with values designated by manufacturers. Table 6-2-7 shows reference values.

Note:

When applying oil to the flare surface, be sure to use oil designated by the manufacturer. If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out.

Table 6-2-7 Tightening torque of flare for R410A [Reference values]

Nominal diameter	Outer diameter (mm)	Tightening torque N·m (kgf·cm)	Tightening torque of torque wrenches available on the market N·m (kgf·m)
1/4	6.35	14 to 18 (140 to 180)	16 (160), 18 (180)
3/8	9.52	33 to 42 (330 to 420)	42 (420)
1/2	12.70	50 to 62 (500 to 620)	55 (550)
5/8	15.88	63 to 77 (630 to 770)	65 (650)

6-3. Tools

6-3-1. Required tools

The service port diameter of packed valve of the outdoor unit in the air conditioner using R410A is changed to prevent mixing of other refrigerant. To reinforce the pressure-resisting strength, flare processing dimensions and opposite side dimension of flare nut (For ∅12.70 copper pipe) of the refrigerant piping are lengthened.

The used refrigerating oil is changed, and mixing of oil may cause a trouble such as generation of sludge, clogging of capillary, etc. Accordingly, the tools to be used are classified into the following three types.

(1) Tools exclusive for R410A (Those which cannot be used for conventional refrigerant (R22))
(2) Tools exclusive for R410A, but can be also used for conventional refrigerant (R22)
(3) Tools commonly used for R410A and for conventional refrigerant (R22)
The table below shows the tools exclusive for R410A and their interchangeability.

Tools exclusive for R410A (The following tools for R410A are required.)

Tools whose specifications are changed for R410A and their interchangeability

No.	Used tool	Usage	R410A air conditioner installation		Conventional air conditioner installation
			Existence of new equipment for R410A	Whether conventional equipment can be used	Whether new equipment can be used with conventional refrigerant
①	Flare tool	Pipe flaring	Yes	*(Note 1)	○
②	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	*(Note 1)	*(Note 1)
③	Torque wrench	Connection of flare nut	Yes	×	×
④	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	×	×
⑤	Charge hose				
⑥	Vacuum pump adapter	Vacuum evacuating	Yes	×	○
⑦	Electronic balance for refrigerant charging	Refrigerant charge	Yes	×	○
⑧	Refrigerant cylinder	Refrigerant charge	Yes	×	×
⑨	Leakage detector	Gas leakage check	Yes	×	○
⑩	Charging cylinder	Refrigerant charge	(Note 2)	×	×

(Note 1) When flaring is carried out for R410A using the conventional flare tools, adjustment of projection margin is necessary. For this adjustment, a copper pipe gauge, etc. are necessary.
(Note 2) Charging cylinder for R410A is being currently developed.

General tools (Conventional tools can be used.)

In addition to the above exclusive tools, the following equipments which serve also for R22 are necessary as the general tools.

(1) Vacuum pump
Use vacuum pump by attaching vacuum pump adapter.
(2) Torque wrench
(3) Pipe cutter
(4) Reamer
(5) Pipe bender
(6) Level vial
(7) Screwdriver (+, –)
(8) Spanner of Monkey wrench
(9) Hole core drill (∅65)
(10) Hexagon wrench (Opposite side 4 mm)
(11) Tape measure
(12) Metal saw

Also prepare the following equipments for other installation method and run check.

(1) Clamp meter
(2) Thermometer
(3) Insulation resistance tester
(4) Electroscope

6-4. Recharging of Refrigerant

When it is necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps.

Recover the refrigerant, and check no refrigerant remains in the equipment.

↓

Connect the charge hose to packed valve service port at the outdoor unit's gas side.

↓

Connect the charge hose of the vacuum pump adapter.

↓

Open fully both packed valves at liquid and gas sides.

↓

Place the handle of the gauge manifold Low in the fully opened position, and turn on the vacuum pump's power switch. Then, evacuating the refrigerant in the cycle.

↓

When the compound gauge's pointer has indicated -0.1 Mpa (-76 cmHg), place the handle Low in the fully closed position, and turn off the vacuum pump's power switch.

↓

Keep the status as it is for 1 to 2 minutes, and ensure that the compound gauge's pointer does not return.

↓

Set the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and charge **liquid refrigerant.**

(For refrigerant charging, see the figure below.)

① Never charge refrigerant exceeding the specified amount.

② If the specified amount of refrigerant cannot be charged, charge refrigerant **bit by bit** in COOL mode.

③ Do not carry out additional charging.

When additional charging is carried out if refrigerant leaks, the refrigerant composition changes in the refrigeration cycle, that is characteristics of the air conditioner changes, refrigerant exceeding the specified amount is charged, and working pressure in the refrigeration cycle becomes abnormally high pressure, and may cause a rupture or personal injury.

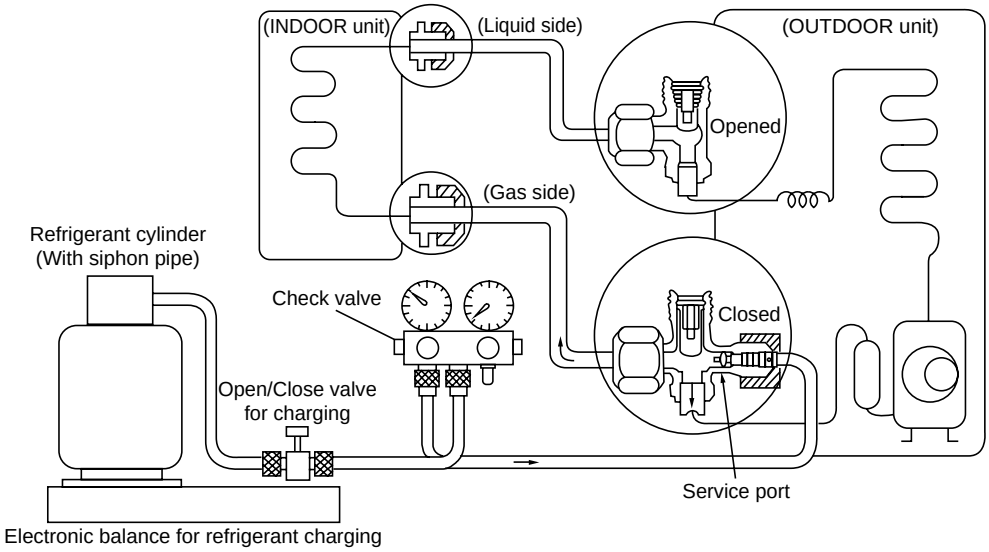


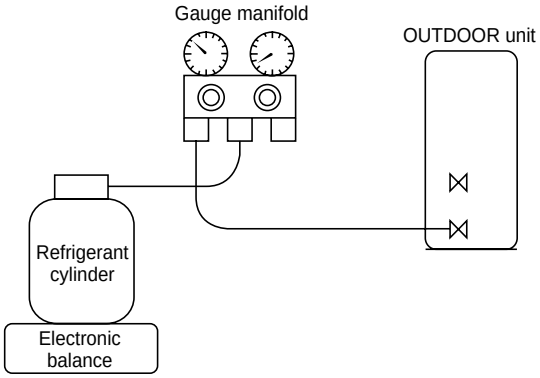
Fig. 6-4-1 Configuration of refrigerant charging

① Be sure to make setting so that **liquid** can be charged.

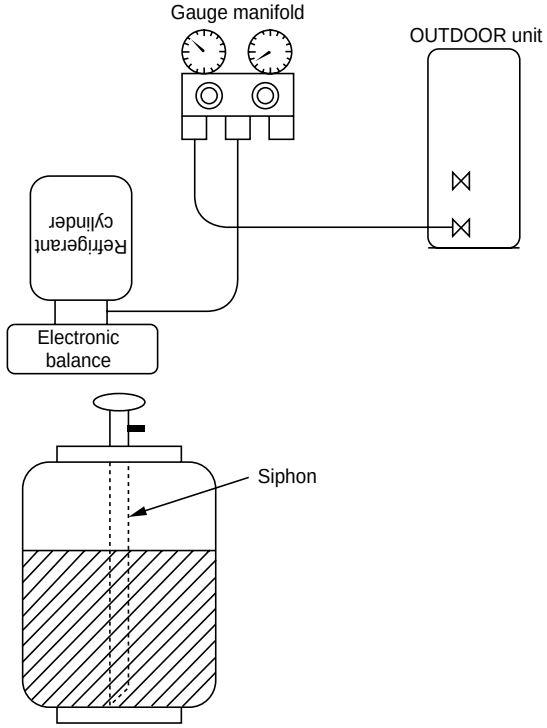
② When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down.

It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon.

[Cylinder with siphon]



[Cylinder without siphon]



R410A refrigerant is HFC mixed refrigerant. Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies.

Fig. 6-4-2

6-5. Brazing of Pipes

6-5-1. Materials for brazing

(1) Silver brazing filler
Silver brazing filler is an alloy mainly composed of silver and copper. It is used to join iron, copper or copper alloy, and is relatively expensive though it excels in solderability.

(2) Phosphor bronze brazing filler
Phosphor bronze brazing filler is generally used to join copper or copper alloy.

(3) Low temperature brazing filler
Low temperature brazing filler is generally called solder, and is an alloy of tin and lead. Since it is weak in adhesive strength, do not use it for refrigerant pipes.

① Phosphor bronze brazing filler tends to react with sulfur and produce a fragile compound water solution, which may cause a gas leakage. Therefore, use any other type of brazing filler at a hot spring resort, etc., and coat the surface with a paint.

② When performing brazing again at time of servicing, use the same type of brazing filler.

6-5-2. Flux

(1) Reason why flux is necessary

- By removing the oxide film and any foreign matter on the metal surface, it assists the flow of brazing filler.
- In the brazing process, it prevents the metal surface from being oxidized.
- By reducing the brazing filler's surface tension, the brazing filler adheres better to the treated metal.

(2) Characteristics required for flux

- Activated temperature of flux coincides with the brazing temperature.
- Due to a wide effective temperature range, flux is hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing filler is minimum.
- It excels in coating performance and is harmless to the human body.

As the flux works in a complicated manner as described above, it is necessary to select an adequate type of flux according to the type and shape of treated metal, type of brazing filler and brazing method, etc.

(3) Types of flux

- **Noncorrosive flux**
  Generally, it is a compound of borax and boric acid.
  It is effective in case where the brazing temperature is higher than 800°C.

- **Activated flux**
  Most of fluxes generally used for silver brazing are this type.
  It features an increased oxide film removing capability due to the addition of compounds such as potassium fluoride, potassium chloride and sodium fluoride to the borax-boric acid compound.

(4) Piping materials for brazing and used brazing filler/flux

Piping material	Used brazing filler	Used flux
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapor flux

① Do not enter flux into the refrigeration cycle.
② When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chloring.
③ When adding water to the flux, use water which does not contain chlorine (e.g. distilled water or ion-exchange water).
④ Remove the flux after brazing.

6-5-3. Brazing

As brazing work requires sophisticated techniques, experiences based upon a theoretical knowledge, it must be performed by a person qualified.
In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry Nitrogen gas (N_2) flow.

Never use gas other than Nitrogen gas.

(1) Brazing method to prevent oxidation

① Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder.
② Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder.
③ Apply a seal into the clearance between the piping material and inserted copper pipe for Nitrogen in order to prevent backflow of the Nitrogen gas.
④ When the Nitrogen gas is flowing, be sure to keep the piping end open.
⑤ Adjust the flow rate of Nitrogen gas so that it is lower than 0.05 m^3/Hr or 0.02 Mpa (0.2 kgf/cm^2) by means of the reducing valve.
⑥ After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands).
⑦ Remove the flux completely after brazing.

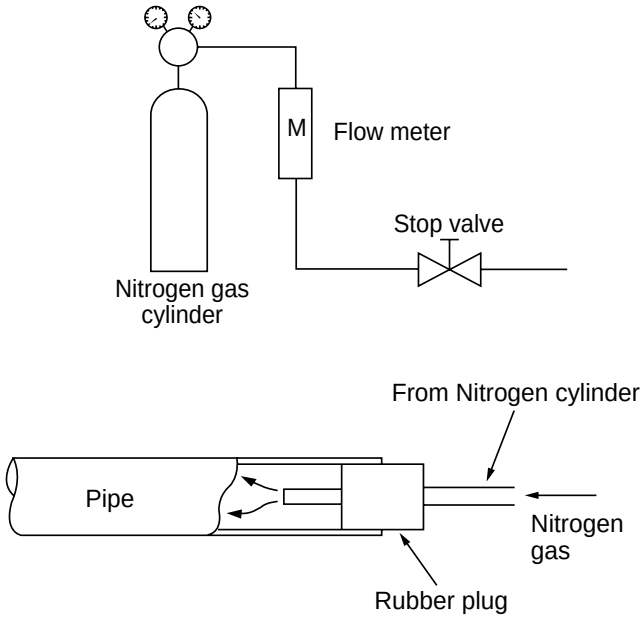
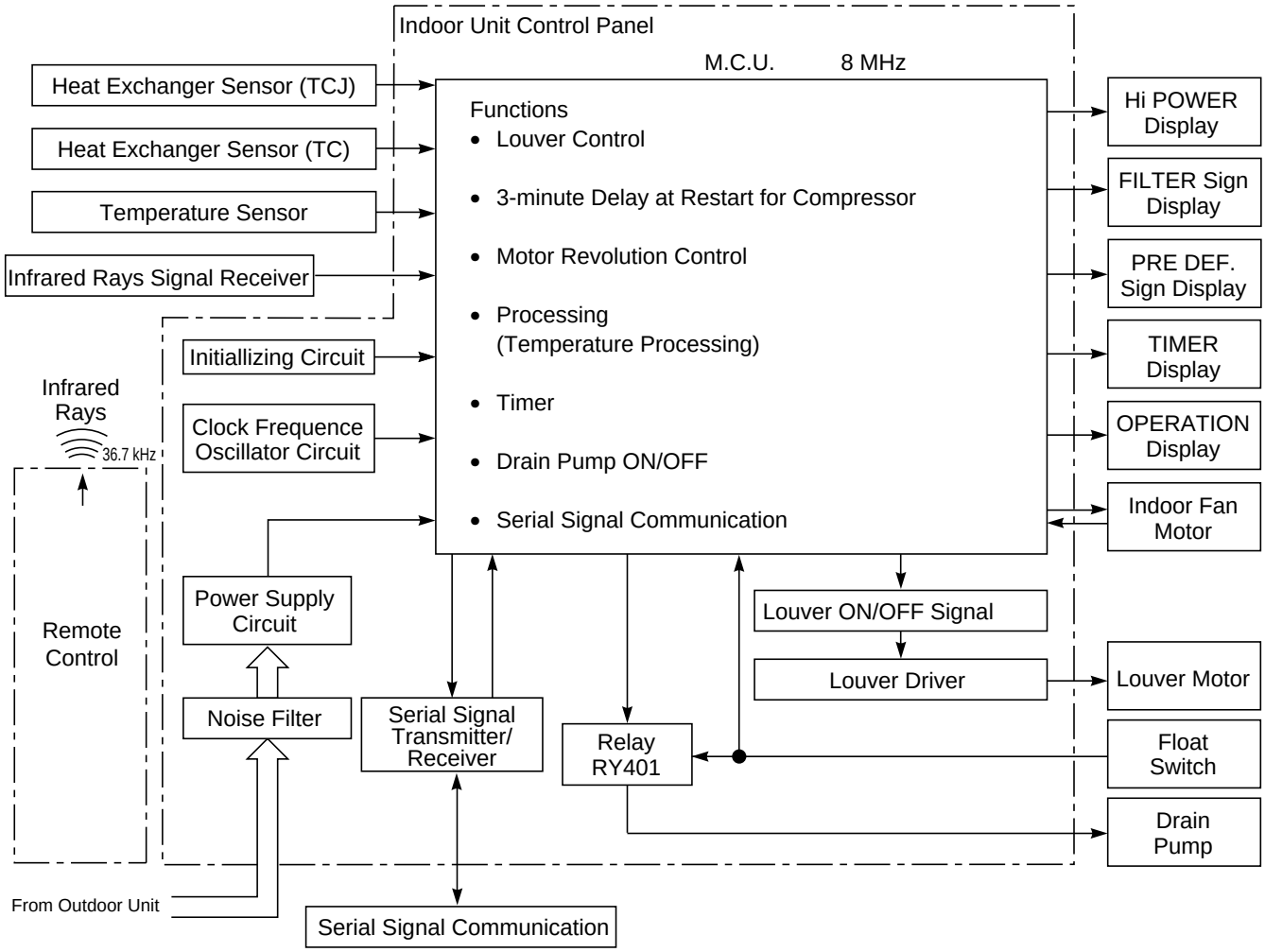
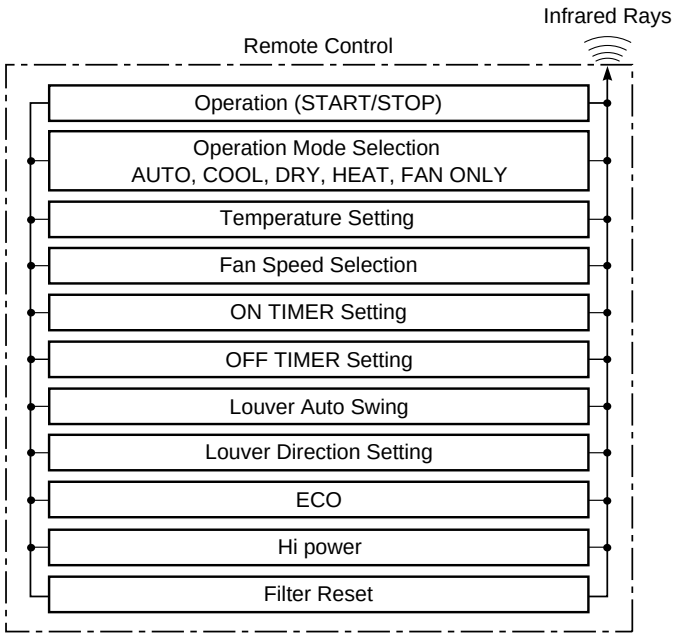


Fig. 6-5-1 Prevention of oxidation during brazing

7. CONTROL BLOCK DIAGRAM



REMOTE CONTROL



8. OPERATION DESCRIPTION

8-1. When power supply is reset

(1) Distinction of outdoor units
When the power supply is reset, the outdoors are distinguished, and control is exchanged according to the distinguished result.

(2) Setting of the indoor fan speed
Based on EEPROM data, rspeed of the indoor fan is selected.

Remarks: Air speed

8-2. Operation mode selection

(1) Based on the operation mode selecting command from the remote control, the operation mode is selected.

Table 8-2-1

Remote control command	Outline of control
STOP	Air conditioner stops.
FAN	Fan operation
COOL	Cooling operation
DRY	Dry operation
HEAT	Heating operation
AUTO	Automatic operation

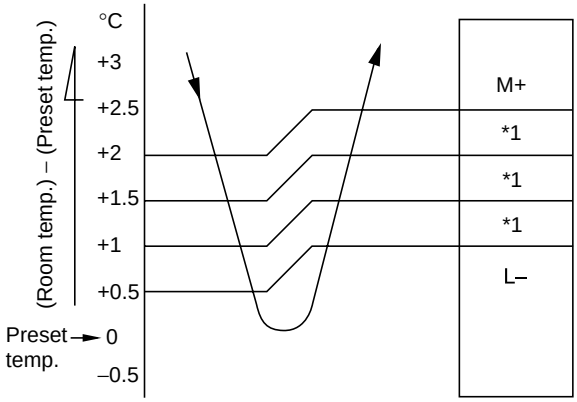
(2) Automatic Operation
- The air conditioner selects and operates in one of the operating modes of cooling, heating or fan only, depending on the room temperature.
- If the AUTO mode is uncomfortable, you can select the desired conditions manually.

8-3. Air volume control

(1) Operation with [HIGH (H)], [MED (M)], [LOW (L)], or [AUTO] mode is performed by the command from the remote control.

(2) When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 8-3-1, Fig. 8-3-2 and Table 8-3-1.

<COOL>



NOTE :

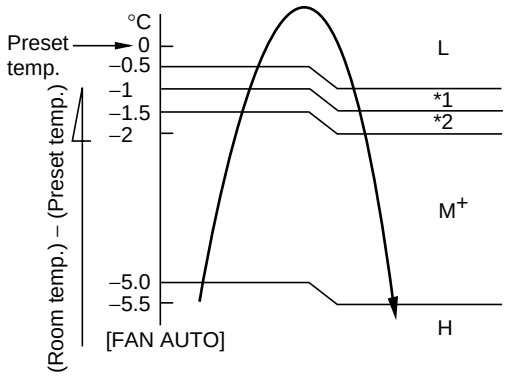
*1: The values marked with *1 are calculated and controlled by the difference in motor speed between M+ and L–.

Fig. 8-3-1

Table 8-2-2

Room temperature in operation	Operating condition	
The set temperature +1°C or higher (in case that the room is hot)	Cooling operation	Performs the cooling operation at a temperature 1°C higher than the setting.
The set temperature –1°C to +1°C	Fan only operation	Performs the fan only operation (low speed) while monitoring the room temperature. When the room temperature changes, the air conditioner will select the cooling or heating mode.
The set temperature –1°C or lower (in case that the room is cold)	Heating operation	Performs the heating operation at a temperature 1°C lower than the setting.

<HEAT>



NOTE :

*1, *2 : The values marked with *1 and *2 are calculated and controlled by the difference in motor speed between M+ and L.

Fig. 8-3-2

Table 8-3-1

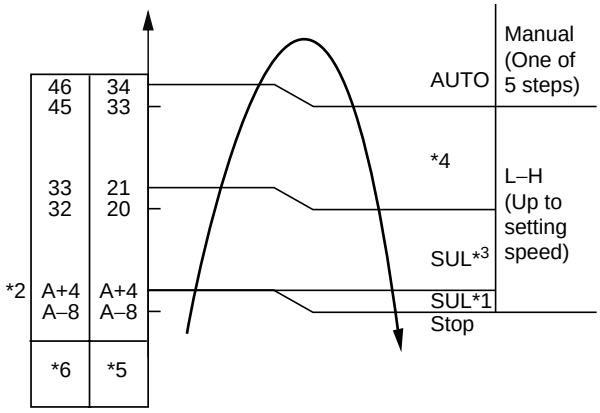
MODEL		RAV-SM560XT-E		RAV-SM800XT-E	
		Motor speed (rpm)	Air flow level (m^3/h)	Motor speed (rpm)	Air flow level (m^3/h)
Cooling and Fan only	HIGH	1060	800	1190	900
	MED	950	690	1010	750
	LOW	800	580	850	650
Heating	HIGH	1120	830	1300	980
	MED	970	730	1070	800
	LOW	820	600	860	650

$$LOW^{+} = \frac{LOW+MED}{2}$$

$$MED^{+} = \frac{MED+HIGH}{2}$$

8-4. Cool air discharge preventive control

In heating operation, the indoor heat exchanger restricts revolving speed of the fan motor to prevent a cold draft. The upper limit of the revolving speed is shown in Fig. 8-4-1 and Table 8-4-1.



NOTES :

*1: The fan stops for 2 minutes after thermostat-OFF.

*2: A is 24°C when the preset temperature is 24°C or more and A is the preset temperature when it is under 24°C.

*3: SUL means Super Ultra Low.

*4: Calculated from difference in motor speed between SUL and HIGH.

Fig. 8-4-1 Cold draft preventing control

*5 and *6:

Table 8-4-1

Fan speed	*5 Starting period	*6 Stabilized period
AUTO	• Up until 12 minutes passed after starting the unit • From 12 to 25 minutes passed after starting the unit and room temperature is 3°C lower than preset temperature	• From 12 to 25 minutes passed after starting the unit and room temperature is between preset temperature and 3°C lower than preset temperature • 25 minutes or more passed after starting the unit
Manual (L – H)	• Room temperature < Preset temperature –4°C	• Room temperature ≧ Preset temperature –3.5°C

8-5. Freeze preventive control (Low temperature release)

The cooling operation (including Dry operation) is performed as follows based on the detected temperature of Tc sensor or Tcj sensor.

When [J] zone is detected for T1 minutes (Following figure), the commanded frequency is decreased from the real operation frequency. After then the commanded frequency changes every 2 minutes while operation is performed in [J] zone.

	T1
Normal	1 minute

In [K] zone, time counting is interrupted and the operation is held.

When [I] zone is detected, the timer is cleared and the operation returns to the normal operation.

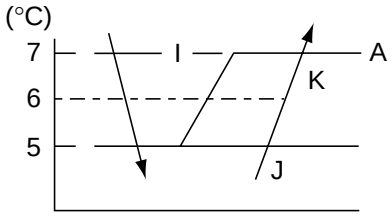


Fig. 8-5-1

In heating operation, the freeze-preventive control works if 4-way valve is not exchanged and the condition is satisfied.

Remarks:
Tcj : Indoor heat exchanger sensor temperature

8-6. High-temp release control

The heating operation is performed as follows based on the detected temperature of Tc sensor.

- When [M] zone is detected, the commanded frequency is decreased from the real operation frequency. After then the commanded frequency changes every 30 seconds while operation is performed in [M] zone.
- In [N] zone, the commanded frequency is held.
- When [L] zone is detected, the commanded frequency is returned to the original value by approx. 6Hz every 60 seconds.

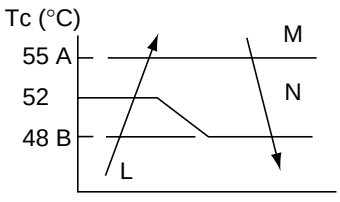


Fig. 8-6-1

8-7. Louver control

(1) Vertical air flow louver
Position of veritcal air flow louver is automatically controlled according to the operation mode. Besides, position of vertical air flow louver can be arbitrarily set by pressing [FIX] button.
The louver position which is set by [FIX] button is stored in the microcomputer, and the louver is automatically set at the stored position for the next operation.

(2) Swing
If [SWING] button is pressed when the indoor unit is in operation, the vertical air flow louver starts swinging. When [SWING] button is pressed, it stops swinging.

8-8. Filter sign display

(1) The operation time of the indoor fan is calculated, the filter lamp (Orange) on the display part of the main unit goes on when the specified time (240H) has passed. When a wired remote controller is connected, the filter reset signal is sent to the remote controller, and also it is displayed on LCD of the wired remote control.

(2) When the filter reset signal has been received from the wired remote control after [FILTER] lamp has gone on or when the filter check button (Temporary button) is pushed, time of the calculation timer is cleared. In this case, the measurement time is reset if the specified time has passed, and display on LCD and the display on the main unit disappear.

Remarks:
[FILTER] goes on

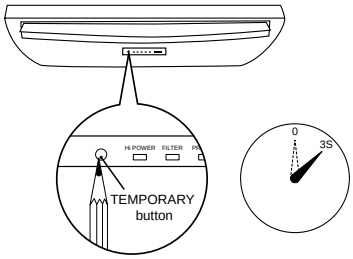
8-9. Auto Restart Function

The indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of power supply being accidentally shut down. The operation will resume without warning three minutes after power is restored.
This function is not set to work when shipped from the factory. Therefore it is necessary to set it to work.

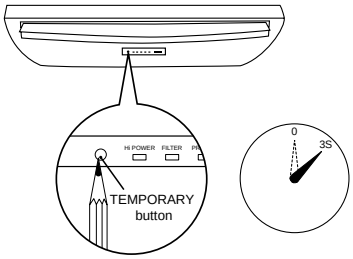
8-9-1. How to set auto restart function

To set the auto restart function, proceed as follows:
The power supply to the unit must be on; the function will not set if the power is off.
Push the [TEMPORARY] button located in the center of the front panel continuously for three seconds.
The unit receives the signal and beeps three times.
The unit then restarts operating automatically in the event of power supply being accidentally shut down.

When the unit is on standby (Not operating)

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The green lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from green to orange. If the unit is not required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it off.

When the unit is in operation

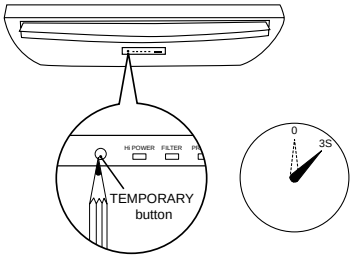
Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is in operation. The green lamp is on. ↓ The unit stops operating. The green lamp is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.
- This function can not be set if the timer operation has been selected.
- When the unit is turned on by this function, the louver will not swing even though it was swinging automatically before shutting down.
- While the filter check lamp is on, the TEMPORARY button has the function of filter reset button.

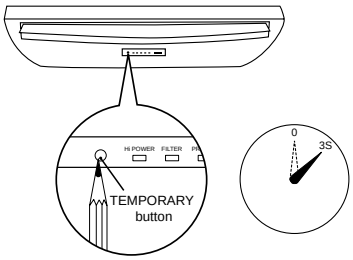
8-9-2. How to cancel auto restart function

To cancel auto restart function, proceed as follows:
Repeat the setting prodedure: the unit receives the signal and beeps three times.
The unit will be required to be turned on with the remote control after the main power supply is turned off.

When the unit is on standby (Not operating)

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The orange lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from orange to green. If the unit is not required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it off.

When the unit is in operation

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is in operation. The orange lamp is on. ↓ The unit stops operating. The orange lamp is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.

8-9-3. Power failure during timer operation

When the unit is in Timer operation, if it is turned off because of power failure, the timer operation is cancelled. Therefore, set the timer operation again.

8-10. Filter Check Lamp

When the elapsed time reaches 1000 hours, the filter check lamp indicates. After cleaning the filters, turn off the filter check lamp.

8-10-1. How to turn off filter check lamp

(1) Press [FILTER] button on the remote control.
(2) Push [TEMPORARY] button on the indoor unit.

Note:
If [TEMPORARY] button is pushed while the filter check lamp is not indicating, the indoor unit will start the Automatic Operation.

9. INSTALLATION PROCEDURE

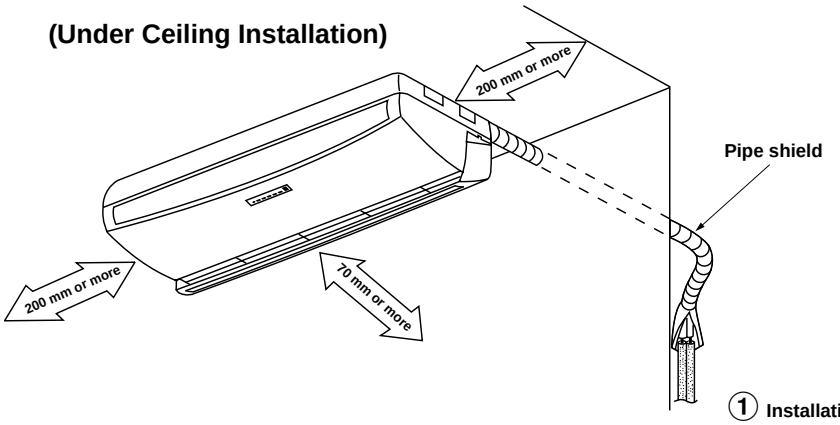
Remark per EMC Directive 89/336/EEC

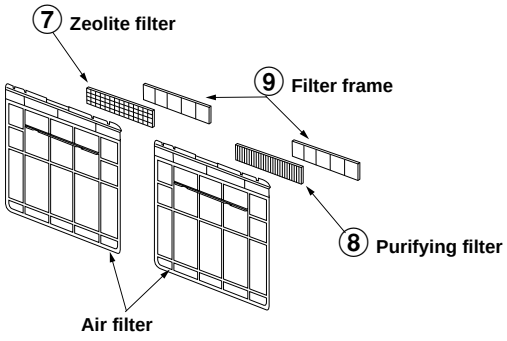
To prevent flicker impressions during the start of the compressor (technical process) following installation conditions do apply.

1. The power connection for the air conditioner has to be done at the main power distribution. This distribution has to be of an impedance.
   Normally the required impedance is reached at a 32A fusing point. Air conditioner fuse has to be 16A max.!
2. No other equipment should be connected to this power line.
3. For detailed installation acceptance, please contact your power supplier whether its restriction does apply for products like washing machines, air conditioners or electrical ovens.
4. For power details of the air conditioner, refer to the rating plate of the product.

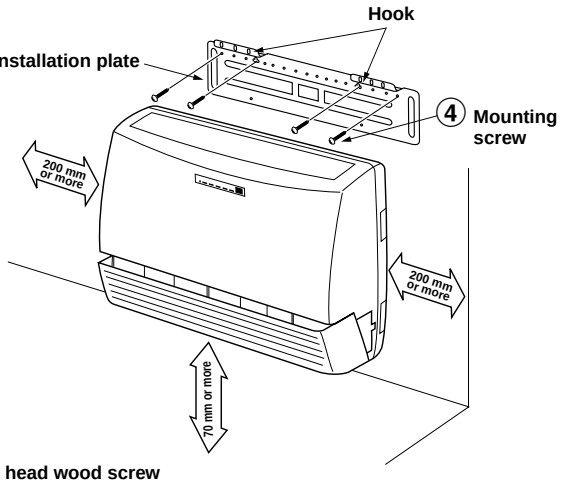
9-1. Installation Diagram of Indoor and Outdoor Units

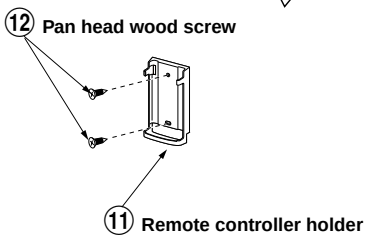
(Under Ceiling Installation)





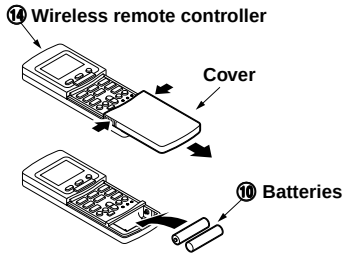
(Console Installation)



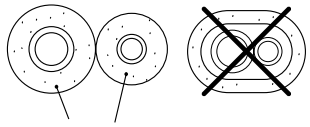


Before install the wireless remote controller

- **With the remote controller cover open, load the batteries supplied correctly, observing their polarity.**



Insulate the refrigerant pipes separately with insulation, not together.



Min 6 mm thick heat resisting polyethylene foam

9-2. PRECAUTIONS FOR SAFETY

- Ensure that all Local, National and International regulations are satisfied.
- Read this “PRECAUTIONS FOR SAFETY” carefully before Installation.
- The precautions described below include the important items regarding safety. Observe them without fail.
- After the installation work, perform a trial operation to check for any problem.
  Follow the Owner’s Manual to explain how to use and maintain the unit to the customer.
- Turn off the main power supply switch (or breaker) before the unit maintenance.
- Ask the customer to keep the Installation Manual together with the Owner’s Manual.

CAUTION **New Refrigerant Air Conditioner Installation**

- **This air conditioner adopts the new HFC refrigerant (R410A) which does not destroy ozone layer.**

The characteristics of R410A refrigerant are ; easy to absorb water, oxidizing membrane or oil, and its pressure is approx. 1.6 times higher than that of refrigerant R22. Accompanied with the new refrigerant, refrigerating oil has also been changed. Therefore, during installation work, be sure that water, dust, former refrigerant, or refrigerating oil does not enter the refrigerating cycle.

To prevent charging an incorrect refrigerant and refrigerating oil, the sizes of connecting sections of charging port of the main unit and installation tools are charged from those for the conventional refrigerant.

Accordingly the exclusive tools are required for the new refrigerant (R410A).

For connecting pipes, use new and clean piping designed for R410A, and please care so that water or dust does not enter. Moreover, do not use the existing piping because there are problems with pressure-resistance force and impurity in it.

CAUTION **To Disconnect the Appliance from Main Power Supply**

This appliance must be connected to the main power supply by means of a switch with a contact separation of at least 3 mm.

The installation fuse (25A D type) must be used for the power supply line of this conditioner.

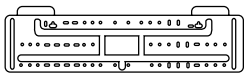
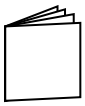
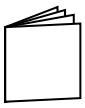
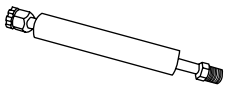
⚠ WARNING

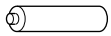
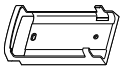
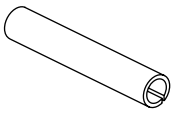
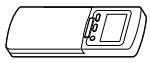
- **Ask an authorized dealer or qualified installation professional to install/maintain the air conditioner.**
  Inappropriate installation may result in water leakage, electric shock or fire.
- **Turn off the main power supply switch or breaker before attempting any electrical work.**
  Make sure all power switches are off. Failure to do so may cause electric shock.
- **Connect the connecting cable correctly.**
  If the connecting cable is connected in a wrong way, electric parts may be damaged.
- **When moving the air conditioner for the installation into another place, be very careful not to enter any gaseous matter other than the specified refrigerant into the refrigeration cycle.**
  If air or any other gas is mixed in the refrigerant, the gas pressure in the refrigeration cycle becomes abnormally high and it may resultingly causes pipe burst and injuries on persons.
- **Do not modify this unit by removing any of the safety guards or by by-passing any of the safety interlock switches.**
- **Exposure of unit to water or other moisture before installation may cause a short-circuit of electrical parts.**
  Do not store it in a wet basement or expose to rain or water.

- **After unpacking the unit, examine it carefully if there are possible damage.**
- **Do not install in a place that might increase the vibration of the unit.**
- **To avoid personal injury (with sharp edges), be careful when handling parts.**
- **Perform installation work properly according to the Installation Manual.**
  Inappropriate installation may result in water leakage, electric shock or fire.
- **When the air conditioner is installed in a small room, provide appropriate measures to ensure that the concentration of refrigerant leakage occur in the room does not exceed the critical level.**
- **Install the air conditioner securely in a location where the base can sustain the weight adequately.**
- **Perform the specified installation work to guard against an earthquake.**
  If the air conditioner is not installed appropriately, accidents may occur due to the falling unit.
- **If refrigerant gas has leaked during the installation work, ventilate the room immediately.**
  If the leaked refrigerant gas comes in contact with fire, noxious gas may generate.
- **After the installation work, confirm that refrigerant gas does not leak.**
  If refrigerant gas leaks into the room and flows near a fire source, such as a cooking range, noxious gas might generate.
- **Electrical work must be performed by a qualified electrician in accordance with the Installation Manual. Make sure the air conditioner uses an exclusive power supply.**
  An insufficient power supply capacity or inappropriate installation may cause fire.
- **Use the specified cables for wiring connect the terminals securely fix. To prevent external forces applied to the terminals from affecting the terminals.**
- **Be sure to provide grounding.**
  Do not connect ground wires to gas pipes, water pipes, lightning rods or ground wires for telephone cables.
- **Conform to the regulations of the local electric company when wiring the power supply.**
  Inappropriate grounding may cause electric shock.
- **Do not install the air conditioner in a location subject to a risk of exposure to a combustible gas.**
  If a combustible gas leaks, and stays around the unit, a fire may occur.

9-3. Accessory parts and Parts to be procured locally

9-3-1. Accessory parts

Part No	Part name	Q'ty	Shape
①	Installation plate	1	
②	Installation Manual	1	
③	Owner's Manual	1	
④	Mounting screw ∅4 x 25 ℓ	8	
⑤	Flexible pipe	1	
⑥	Drain nipple (Packaged with the outdoor unit)	1	
⑦	Zeolite filter	1	

Part No	Part name	Q'ty	Shape
⑧	Purifying filter	1	
⑨	Filter frame	2	
⑩	Battery	2	
⑪	Remote controller holder	1	
⑫	Pan head wood screw ∅3.1 x 16 ℓ	2	
⑬	Pipe shield	1	
⑭	Wireless remote controller	1	

9-3-2. Parts to be procured locally

Connecting pipe (Liquid side) (6.35 mm (diam.), Nominal (diam.) 1/4" thick 0.8 mm) RAV-SM560XT-E, RAV-SM560AT-E (9.52 mm (diam.), Nominal (diam.) 3/8" thick 0.8 mm) RAV-SM800XT-E, RAV-SM800AT-E
Connecting pipe (Gas side) (12.7 mm (diam.), Nominal (diam.) 1/2" thick 0.8 mm) RAV-SM560XT-E, RAV-SM560AT-E (15.9 mm (diam.), Nominal (diam.) 5/8" thick 1.0 mm) RAV-SM800XT-E, RAV-SM800AT-E
Power supply cord 2.5 mm^2 (H07RN-F or 245IEC66) or 3.5 mm^2 (AWG-12)

Connecting cable H07RN-F or 245IEC66 (1.5 mm^2 or more)
Thermal insulation for refrigerant pipe (10 mm or more, thermal insulating foam polyethylene)
Thermal insulation for drain pipe (10 mm or more, foam polyethylene)
Drain pipe (Outer 26 mm (diam.))
Tapes
Grounding cable (2.0 mm (diam.) or more)

9-4. SELECTION OF INSTALLATION PLACE

⚠ WARNING

- **Install the air conditioner where there is sufficient strength to withstand the weight of the unit.**
  If the strength is not sufficient, the unit may fall down resulting in injury.

CAUTION

Upon approval of the customer, install the air conditioner in a place that satisfies the following conditions.

- Place where the unit can be installed horizontally.
- Place where a sufficient servicing space can be ensured for safe maintenance and check.
- Place where drained water will not cause any problem.

Avoid installing in the following places.

- Place exposed to air with high salt content (seaside area), or place exposed to large quantities of sulfide gas (hot spring). (Should the unit be used in these places, special protective measures are needed.)
- Place exposed to oil, vapor, oil smoke or corrosive gas.
- Place where organic solvent is used nearby.
- Place close to a machine generating high frequency.
- Place where noise of the outdoor unit is easy to transmit.
  (When installing the air conditioner on the boundary with the neighbor, pay due attention to the level of noise.)
- Place with poor ventilation.
- Where the ceiling height is more than 3 m.
- Where the floor/wall/ceiling structure is unable to support the weight of the unit.

9-5. INSTALLATION OF INDOOR UNIT

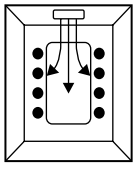
⚠ WARNING

- **Install the air conditioner certainly at a place to sufficiently withstand the weight.**
  If the strength is insufficient, the unit may fall down resulting in human injury.
- **Perform a specified installation work to guard against an earthquake.**
  An incomplete installation can cause accidents by the units falling and dropping.

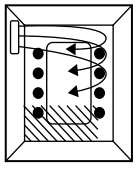
Locate the unit so as to provide uniform circulation of chilled air.

Avoid locating the unit as shown in the bad-marked figures below:

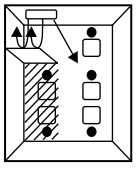
Good location
Evenly hot or cooled



Bad location
Shaded area well hot or cooled



Bad location
Shaded area well hot or cooled



If a good location is not possible, use a fan to circulate the air evenly throughout the room.

9-5-1. Installation Place

- A place which provides the spaces around the indoor unit as shown in the above diagram.
- A place where there is no obstacle near the air inlet and outlet.
- A place that allows easy installation of the piping to the outdoor unit.
- A place which allows the Front panel to be opened.

CAUTION

- Direct sunlight or fluorescent light to the indoor unit's wireless receiver should be avoided.
- The microprocessor in the indoor unit should not be too close to RF noise sources. (For details, see the owner's manual.)

<Remote controller>

- A place where there are no obstacles such as a curtain that may block the signal from the indoor unit.
- Do not install the remote controller in a place exposed to direct sunlight or close to a heating source, such as a stove.
- Keep the remote controller at least 1 m apart from the nearest TV set or stereo equipment. (This is necessary to prevent image disturbances or noise interference.)
- The location of the remote controller should be determined as shown below.

<Remote controller usage>

- Under Ceiling Installation

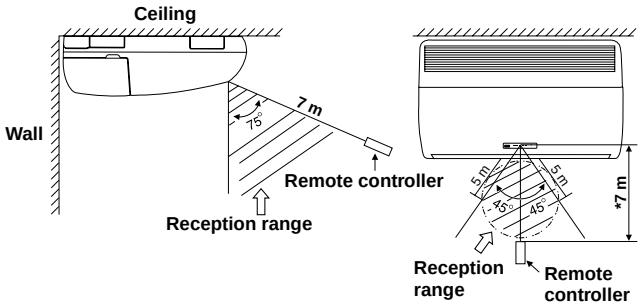


Fig. 9-5-1

- Console Installation

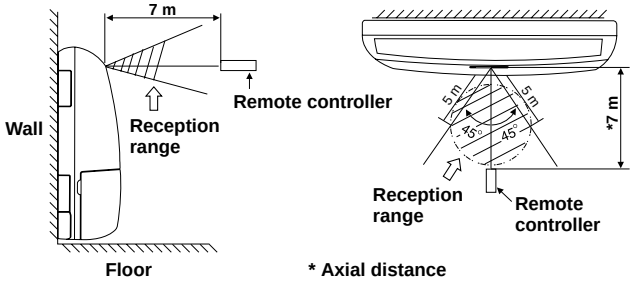


Fig. 9-5-2

NOTICE

The Paper pattern is inside the package box cover. Do not bend and dispose of it before installing.

9-5-2. Before Installation

<Remove the Air inlet grille>

1. Open the Air inlet grille by both hands.
2. Loosen three screws for fixing the Panel arm. Do not remove the screws at this time.

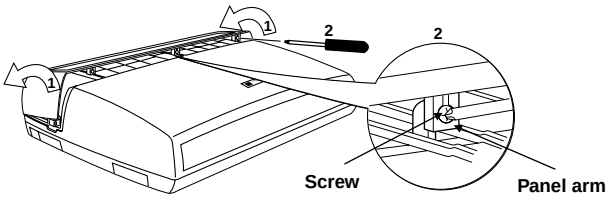


Fig. 9-5-3

3. First, move the Air inlet grille upward, then turn it backwards.
4. Remove the Grille stopper from the axis of the Front panel. After that, remove the Air inlet grille.
5. Remove the Panel arms from the Front panel.

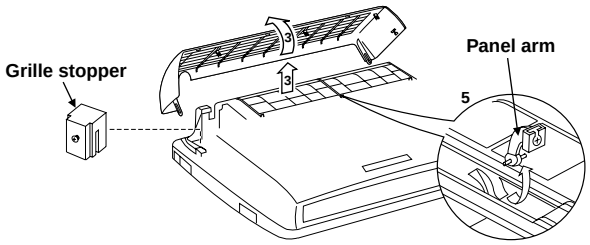


Fig. 9-5-4

9-5-3. After Installation

<Install the Air inlet grille>

1. Insert the three Panel Arms on the Air inlet grille and fix each securely by screws.

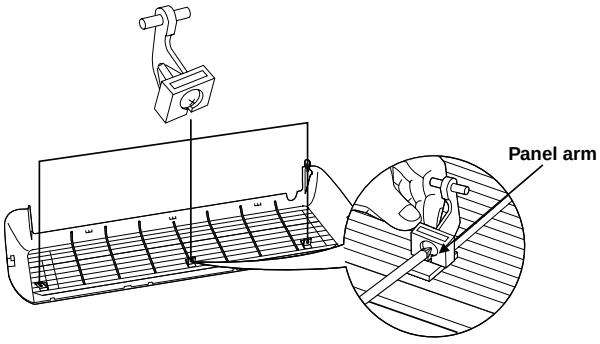


Fig. 9-5-5

CAUTION

- The screws that fixed with Panel Arms must not be loose.

2. Set the Air inlet grille arm to the axis of the Front panel.
3. Insert the Grille stopper to the correct position and fix it securely with screws.
4. Push the Air inlet grille to the correct position.

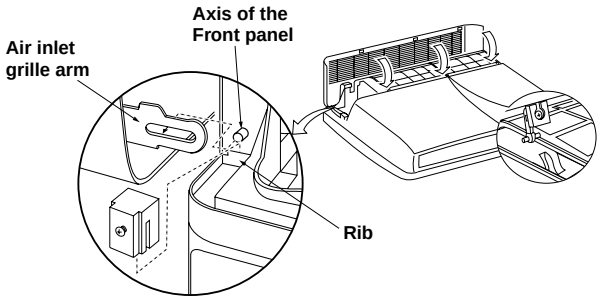


Fig. 9-5-6

9-5-4. Under Ceiling Installation

For the installation of the indoor unit use the Paper pattern, which is inside the package box cover.

<Install the Suspension bolts>

- Install the Suspension bolts so that it can support the indoor unit.

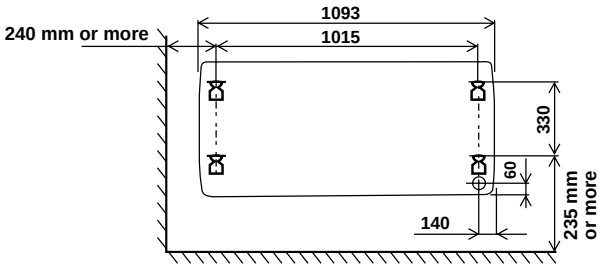


Fig. 9-5-7

- Adjust distance to ceiling before installation.

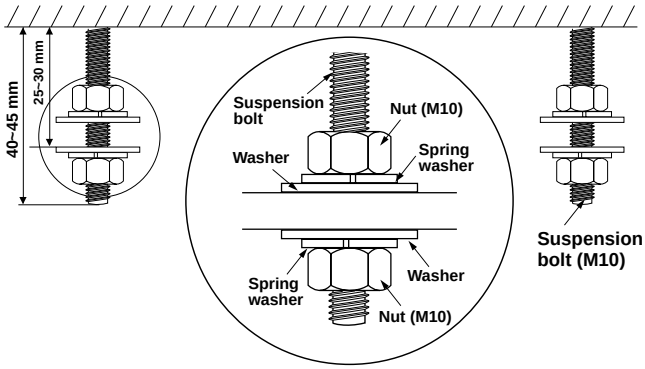


Fig. 9-5-8

<Install the indoor unit>

1. Remove the Side covers and the Installation plate ①.
2. Insert the Suspension bolts into the metal fittings of the indoor unit.
3. Set to nuts, spring washers and washers on both sides of the metal fittings and then move the indoor unit backward.
4. Secure it with the M10 Nuts. (4 pcs.)
5. Attach the Side covers to the unit.

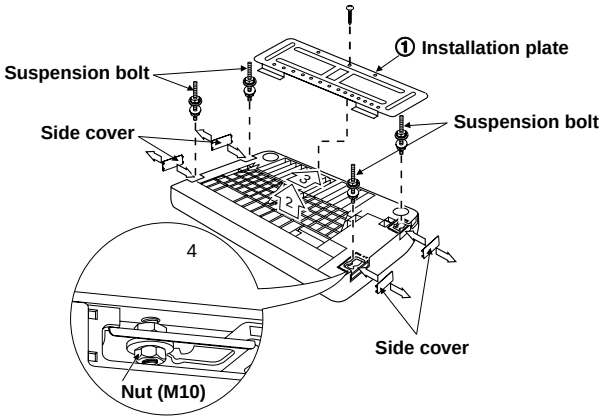


Fig. 9-5-9

<Condition for Installation>

- The unit must not decline more than 15 mm in either axis.

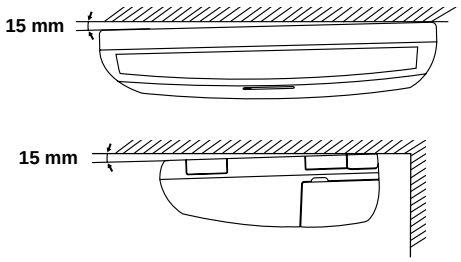


Fig. 9-5-10

<Piping and Drain Hose Installation>

- The piping direction can be 4 ways as illustrated.
- The Drain hose is only one way.

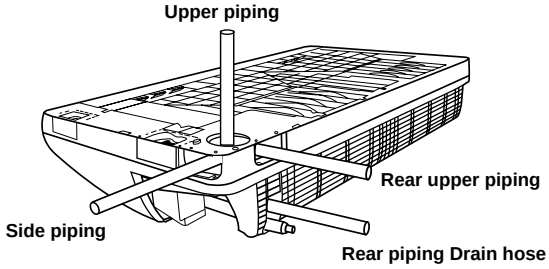


Fig. 9-5-11

• How to install the Drain hose.

1. Remove the two screws and the Drain band.
2. Cut a slit for the drain hose hole.

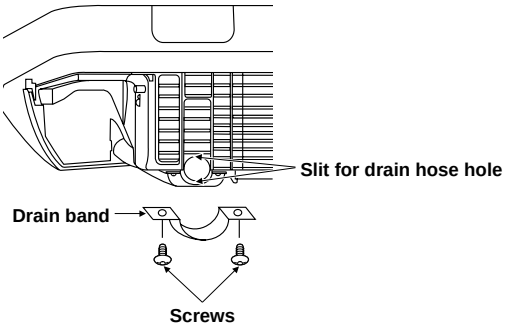


Fig. 9-5-12

3. Place the Drain hose on the U-shape space and secure it with the Drain band and two screws.

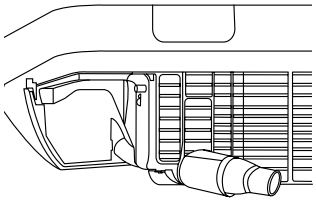


Fig. 9-5-13

• Rear side piping with Drain hose. (Recommended direction)

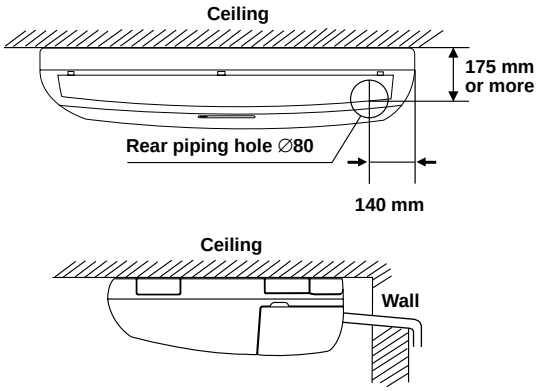


Fig. 9-5-14

1. Cut or remove the determined direction slit or cover.
2. Pipes and the Drain hose should be fixed together by the Drain band with two screws.

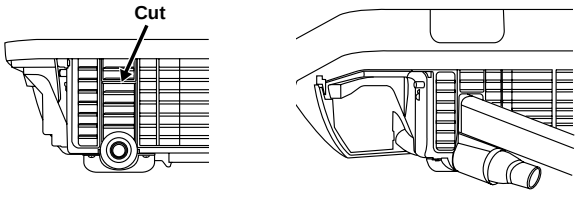


Fig. 9-5-15

• Other direction piping.

1. Cut the slit of connecting only upper direction.

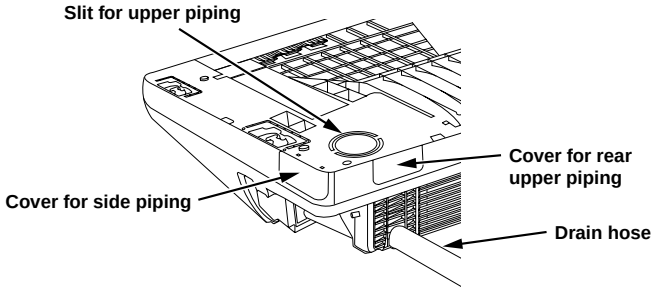


Fig. 9-5-16

2. Connect the Flexible pipe ⑤ to the large pipe (Gas side).

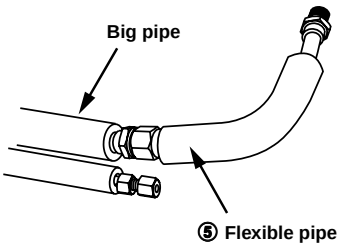


Fig. 9-5-17

9-5-5. Console Installation

- Select the terminal of Selector-SW from [C position] to [F position].

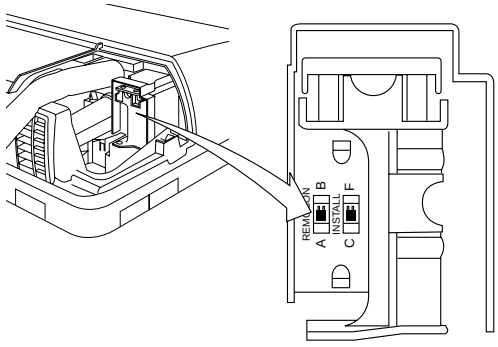


Fig. 9-5-18

<Cutting a hole and mounting the Installation plate>

- When installing the rear piping, determine the pipe hole position, drill the pipe hole (∅80 mm) at a slight downward slant to the outdoor side.
- For mounting of the Installation plate ①, use the Paper pattern, which is inside the package box cover.

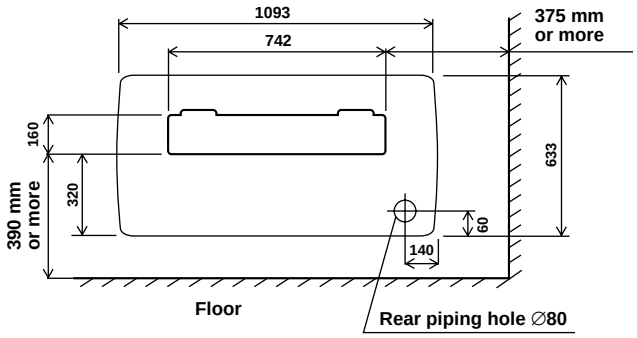


Fig. 9-5-19

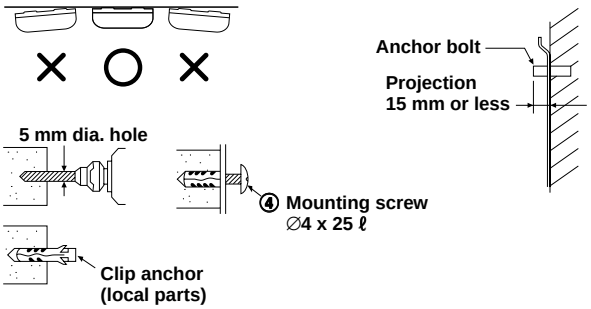


Fig. 9-5-20

CAUTION

Failure to firmly install the unit may result in personal injury and property damage if the unit falls.

- In case of block, brick, concrete or similar type walls, make 5 mm dia. holes in the wall.
- Insert clip anchors for appropriate Mounting screws ④.

NOTE :

- Secure four corners and lower parts of the Installation plate ① with 6 to 8 mounting screws to install it.

<Install the indoor unit>

- Install the Installation plate ① at the wall according to the Paper pattern.
- Hang the indoor unit on the hooks of the Installation plate ①.
- Fix the lower portion of the indoor unit with Mounting screws ④ (2 places).

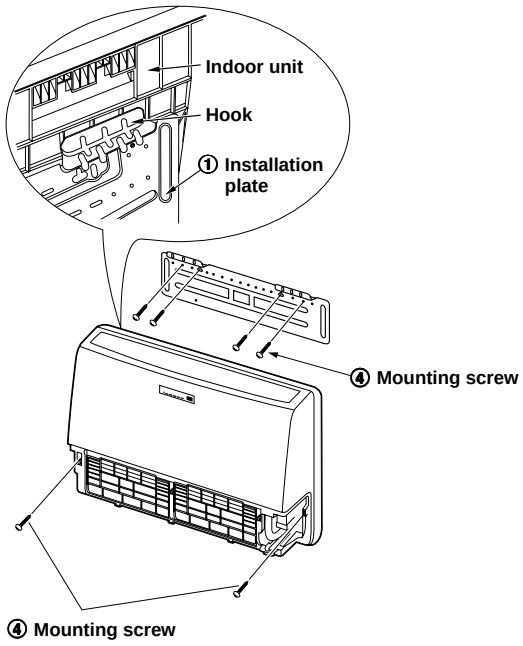


Fig. 9-5-21

<Condition for installation>

- The unit must not decline more than 15 mm in either axis.

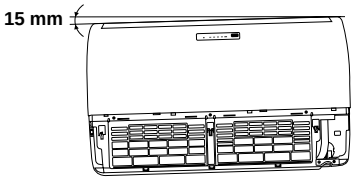


Fig. 9-5-22

<Piping and Drain Hose Installation>

- The piping direction can be the following 3 ways with the Drain hose.
- Each piping direction should be connected with the Flexible pipe ⑤.

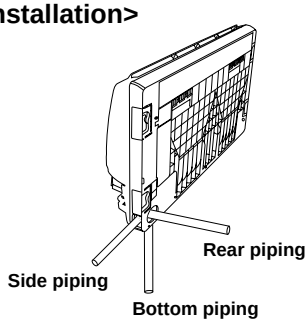


Fig. 9-5-22

- Cut or remove the determined direction slit or cover.

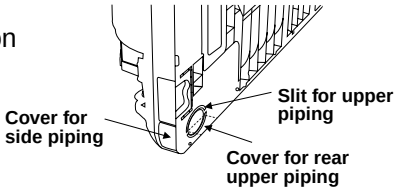


Fig. 9-5-23

9-6. DRAIN PIPING WORK

9-6-1. Drainage

1. Run the Drain hose sloping downward.

NOTE :

- The hole should be made at a slight downward slant on the outdoor side.

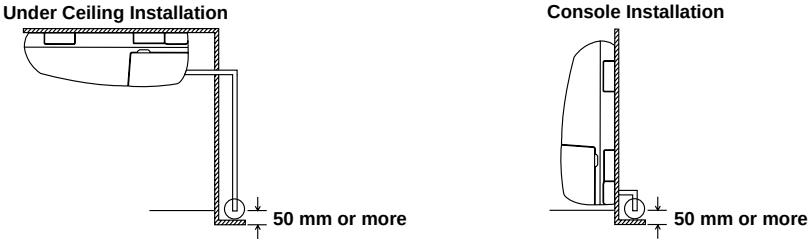


Fig. 9-6-1

NOTICE

In case of upward drainage from the unit, (Under Ceiling Installation), it is necessary to use the Drain pump kit of optional part.

CAUTION

1. Do not raise the Drain hose.
2. Do not put the Drain hose into water.
3. Do not form the Drain hose into a wave shape.
4. Do not put the Drain hose end in the drainage ditch.

2. Open the louver manually and put some water into it.
   Then check the flow of water from the Drain hose.

Fig. 9-6-2

3. When connecting the Extension drain hose; insulate the connecting part of Extension drain hose with the Pipe shield.

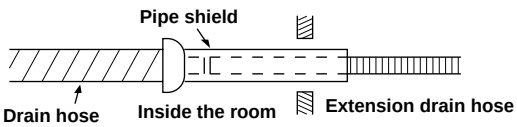


Fig. 9-6-3

CAUTION

Arrange the drain pipe for proper drainage from the unit.
Improper drainage can result in dew-dropping. (Provide by customer)

9-7. REFRIGERANT PIPING

9-7-1. Refrigerant Piping

1. If the outdoor units are to be mounted on a wall, make sure that the platform supporting is sufficiently strong. The platform should be designed and manufactured to maintain its strength over a long period of time, and sufficient consideration should be given to ensuring that the outdoor unit will not fall.
2. **Use copper pipe with 0.8 mm or more thickness.**
3. Flare nut and flare works are also different from those of the conventional refrigerant. Take out the flare nut attached to the main unit of the air conditioner, and use it.

CAUTION

IMPORTANT 4 POINTS FOR PIPING WORK

1. Take away dust and moisture from the inside of the connecting pipes.
2. Tight connection (between pipes and unit)
3. Evacuate the air in the connecting pipes using VACUUM PUMP.
4. Check the gas leakage. (Connected points)

9-7-2. Permissible Piping Length and Head

The maximum piping length from the outdoor to indoor unit		The maximum height difference outdoor/indoor unit	
30 m (Without charge 20 m) (RAV-SM560AT-E)	50 m (Without charge 20 m) (RAV-SM800AT-E)	Outdoor unit is above	Outdoor unit is below
		30 m	15 m

<Flaring>

Insert a flare nut into the pipe, and flare the pipe.

As the flaring sizes of R410A differ from those of refrigerant R22, the flare tools newly manufactured for R410A are recommended.

However, the conventional tools can be used by adjusting projection margin of the copper pipe.

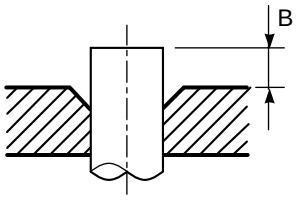


Fig. 9-7-1

- **Projection margin in flaring : B (Unit : mm)**

Rigid (Clutch type)

Outer diam. of copper pipe	R410A tool used		Conventional tools used	
	R410A	R22	R410A	R22
6.35/9.52	0 to 0.5	(Same as left)	1.0 to 1.5	0.5 to 1.0
12.7/15.9	0 to 0.5	(Same as left)	1.0 to 1.5	0.5 to 1.0

Imperial (Wing nut type)

Outer diam. of copper pipe	R410A	R22
6.35/9.52	1.5 to 2.0	1.0 to 1.5
12.7/15.9	2.0 to 2.5	1.5 to 2.0

- **Flaring dia meter size : A (Unit : mm)**

Outer diam. of copper pipe	$A^{+0}_{-0.4}$	
	R410A	R22
6.35	9.1	9.0
12.7/15.9	16.6	16.2

* In the case of the flaring for R410A with the conventional flare tool, pull out it approx. 0.5 mm more than that for R22 to adjust to the specified flare size.

The copper pipe gauge is useful for adjusting projection margin size.

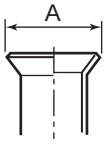


Fig. 9-7-2

<Tightening connection>

Align the centers of the connecting pipes and tighten the flare nut as far as possible with your fingers. Then tighten the nut with a spanner and torque wrench as shown in the figure.

CAUTION

- Do not apply excess torque. Otherwise, the nut may crack depending on the conditions.

(Unit : N•m)

Outer diam. of copper pipe	Tightening torque
6.35 mm (diam.)	14 to 18 (1.4 to 1.8 kgf•m)
9.52 mm (diam.)	33 to 42 (3.3 to 4.2 kgf•m)
12.7 mm (diam.)	50 to 62 (5.0 to 6.2 kgf•m)
15.9 mm (diam.)	63 to 77 (6.3 to 7.7 kgf•m)

- **Tightening torque of flare pipe connections**

  Pressure of R410A becomes higher than that of R22. (Approx. 1.6 times) Therefore, using a torque wrench, tighten firmly the flare pipe connecting sections which connect the indoor and outdoor units up to the specified tightening torque.

  Incorrect connections may cause not only a gas leakage, but also a trouble of the refrigeration cycle or compressor damage.

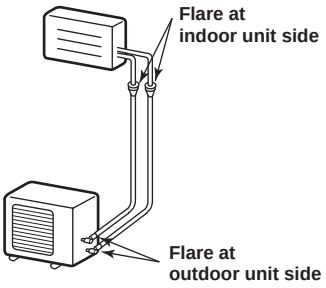


Fig. 9-7-3

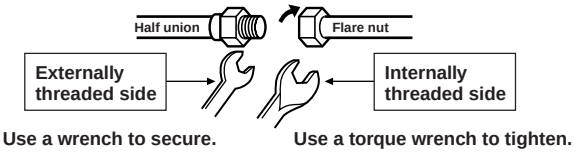


Fig. 9-7-4

9-7-3. Pipe Shield for Flare Nut Connection

Joints in liquid and gas pipes of the indoor unit should be insulated with an attached Pipe shield ⑬.

<How to install the pipe shield>

1. Cut the Pipe shield ⑬ to appropriate length.
2. Set the Pipe shield ⑬.
3. In case of a ceiling installation, orient the slit at the top of the pipe.
4. Fix the Pipe shield ⑬ with vinyl tape.

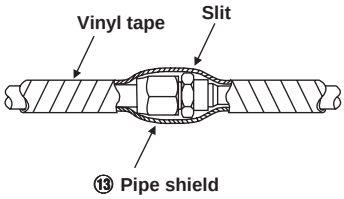


Fig. 9-7-5

9-8. EVACUATING

AIR PURGE

Evacuate the air in the connecting pipe and in the indoor unit using vacuum pump.
Do not use the refrigerant in the outdoor unit.
For details, see the manual of vacuum pump.

9-8-1. Use a vacuum pump

Be sure to use a vacuum pump with counter-flow prevention function so that inside oil of the pump does not flow backward into pipe of the air conditioner when the pump stops.

1. Connect the charge hose from the manifold valve to the service port of the gas side packed valve.
2. Connect the charge hose to the port of vacuum pump.
3. Open fully the low pressure side handle of the gauge manifold valve.
4. Operate the vacuum pump to start for evacuating. Perform evacuating for about 35 minutes if the piping length is total 30 meters for model SM560 and 50 meters for model SM800.
   (assuming a pump capacity of 27 liters per minute.)
   Then confirm that the compound pressure gauge reading is –101 kPa (–76 cmHg).
5. Close the low pressure side valve handle of gauge manifold.
6. Open fully the valve stem of the packed valves (both sides of Gas and Liquid).
7. Remove the charging hose from the service port.
8. Securely tighten the caps on the packed valves.

NOTE :

- Use the vacuum pump, vacuum pump adapters, and gauge manifold referring to the manuals attached to each tool before using them.

  For the vacuum pump, check oil is filled up to the specified line of the oil gauge.
- While the air is purged, check again that the connecting port of charge hose, which has a projection to push the valve core, is firmly connected to the charge port.

Valve handling precautions

- Open the valve stem or the handle until it strikes the stopper. It is unnecessary to apply further force.
- Securely tighten the cap with a torque wrench.

Cap tightening torque

Valve size	∅6.4	14 to 18 N•m (1.4 to 1.8 kgf•m)
	∅9.5	33 to 42 N•m (3.3 to 4.2 kgf•m)
	∅12.7	33 to 42 N•m (3.3 to 4.2 kgf•m)
	∅15.9	20 to 25 N•m (2.0 to 2.5 kgf•m)
Charge port		14 to 18 N•m (1.4 to 1.8 kgf•m)

9-8-2. Additional refrigerant

1. The amount of refrigerant put into the outdoor unit at the factory is sufficient to fill up to 20 m of refrigerant piping work.
2. If the length of the refrigerant piping work is 20 m or less, addition of refrigerant at the installation site is unnecessary.
3. If the length of the piping work exceeds 20 m, extra refrigerant must be added. Refer to the outdoor installation manual for details of the extra amounts.
4. Overcharge or undercharge of refrigerant in the outdoor unit may cause malfunction of the compressor.

Add Only R410A Refrigerant to These Units

9-8-3. Heat insulation

1. Provide heat insulation on the refrigerant piping on both the liquid side and gas side separately, and ensure that all joints in the insulation are completely sealed (without gap).
2. Since the temperature of the piping on the gas side increases during heating operations, the heat insulating material used must be able to withstand temperatures of more than 120°C.
3. Use the pipe insulation supplied in the accessory pack to insulate the piping connecting section on the indoor unit side.

9-8-4. Packed valve handling precautions

- Open the valve stem all the way out; do not try to open it beyond the stopper.
- Securely tighten the valve stem cap in torque as follows:

Gas side (12.7 mm (diam.))	50 to 62 N•m (5.0 to 6.2 kgf•m)
Liquid side (9.52 mm (diam.))	33 to 42 N•m (3.3 to 4.2 kgf•m)
Liquid side (6.35 mm (diam.))	14 to 18 N•m (1.4 to 1.8 kgf•m)
Service port	14 to 18 N•m (1.4 to 1.8 kgf•m)

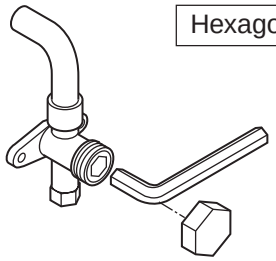


Fig. 9-8-1

<For RAV-SM800AT-E model>

- As shown in the figure, be sure to use a double spanner to loosen or tighten the flare nut of the valve at gas side. If using a single spanner, the nut cannot be tightened with necessary tightening torque.

SM800 type valve at gas side

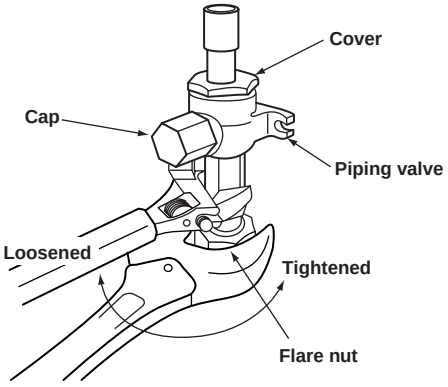


Fig. 9-8-2

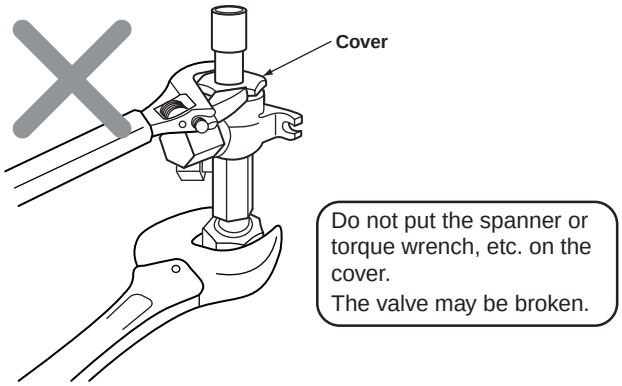


Fig. 9-8-3

- On the contrary, use a single spanner to loosen or tighten the flare nut of the valve at liquid side.

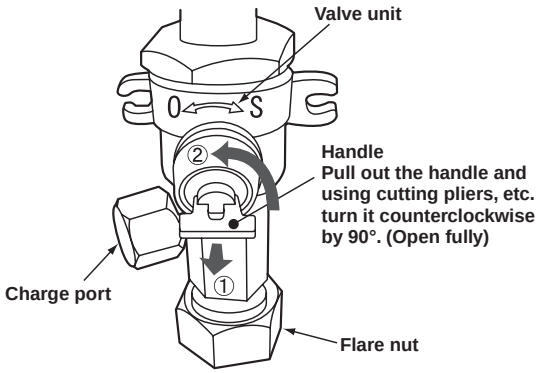


Fig. 9-8-4

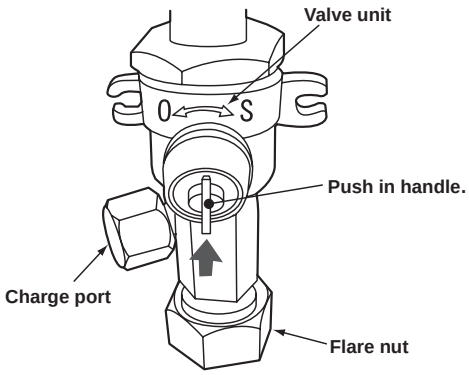


Fig. 9-8-5

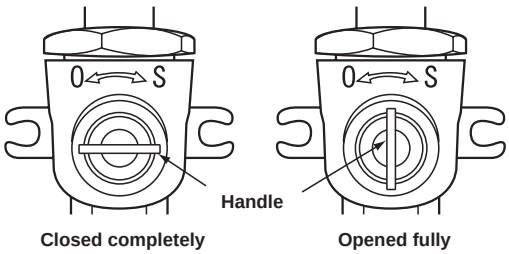


Fig. 9-8-6

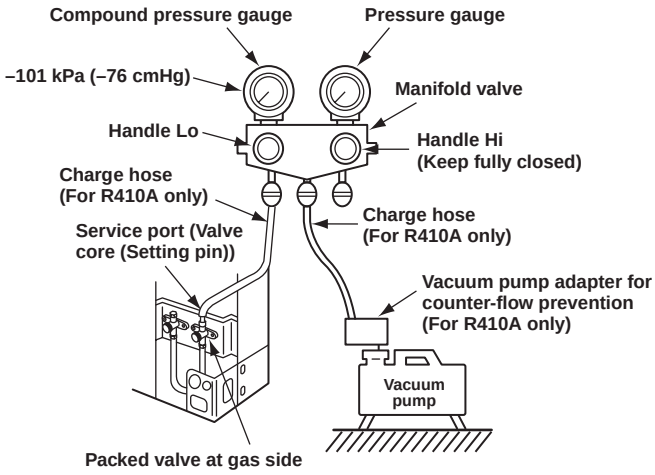


Fig. 9-8-7

<For RAV-SM560AT-E model>

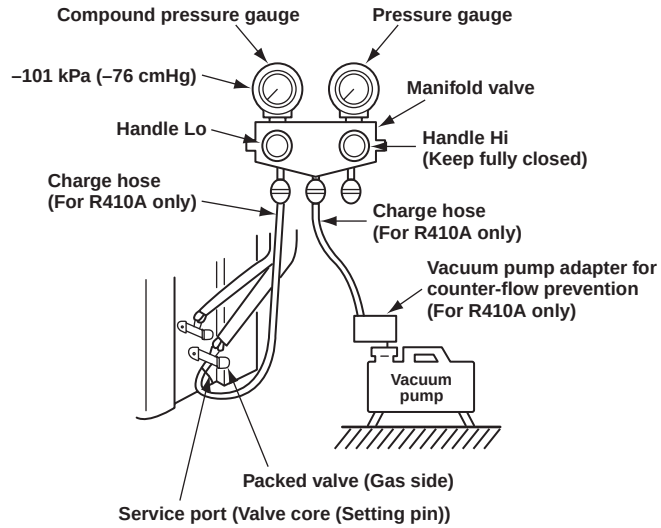


Fig. 9-8-8

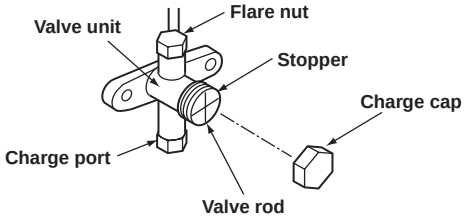


Fig. 9-8-9

9-9. ELECTRICAL WORK

For the air conditioner that has no power cord.

NOTE :

For selection and connection method of the power supply cords, refer to the details in the Installation Manual of the outdoor unit.

CAUTION

- If incorrect/incomplete wiring is carried out, it may cause an electrical fire or smoke.
- Prepare the power supply for exclusive use with the air conditioner.
- Be sure to use the cord clamps specified positions with attached to the product.
- Do not damage or scratch the conductive core and inner insulator of power and inter-connecting cables when peeling them.
- Be sure to comply with local cords on running the wire from outdoor unit to indoor unit (size of wire and wiring method etc.)
- Use the power cord and Inter-connecting cable with specified thickness, specified type, and protective devices specified.

9-9-1. How to wire

1. Connect the connecting cable to the terminal as identified with their respective matched numbers on the terminal block of indoor and outdoor unit. H07RN-F or 245IEC66 (1.5 mm^2 or more)
2. Insulate the unsheathed redundant cords (conductors) with electrical insulation tape. Process them so that they do not touch any electrical or metal parts.
3. For inter-unit wiring, do not use a cut wire jointed to another on the way.

9-9-2. Stripping length of connecting cable

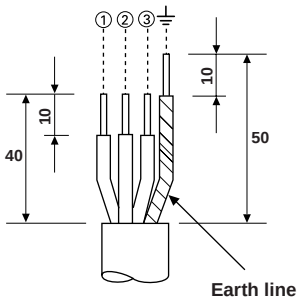


Fig. 9-9-1

NOTE :

Use stranded wire only.

- Wire type : More than 1.5 mm^2 (H07RN-F or 245IEC66) or 1.3 mm^2 (AWG-16)

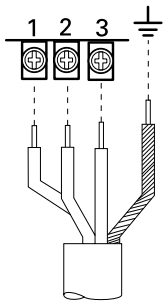


Fig. 9-9-2

NOTE :

Connect the earth line to the metallic part (⏚ mark) located at the side of 3P terminal.

9-9-3. Wiring between units

1. Connect the wires between the units correctly. Errors made in the connections can result in the unit malfunctioning.
2. Connect the control wires between the outdoor unit and indoor unit as shown in the figure below:

9-9-4. Wiring Connections

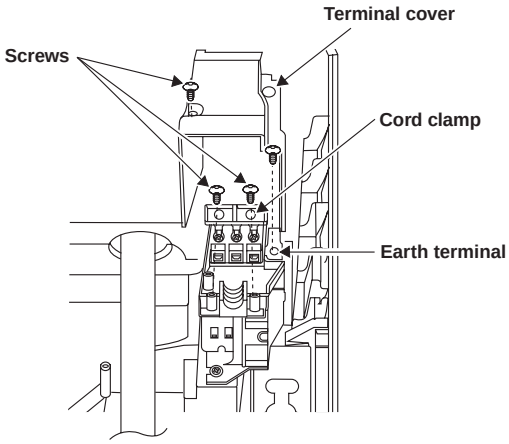


Fig. 9-9-3

1. Remove the Terminal cover and the Cord clamp.
2. Insert the connecting cable into the pipe hole on the wall.
3. Insert the connecting cable fully into the terminal block and secure it tightly with the screw. Tightening Torque: 1.2 N•m (0.12 kgf•m)
4. Fix the connecting cable by the Cord clamp with two screws.
5. Fix the Terminal cover.

9-10. FINAL INSTALLATION CHECKS

9-10-1. Precautions

Ensure that the electrical cable used for power supply and control of the system is unable to come into contact with either service valves or piping work which are not insulated.

9-10-2. Electrical wiring

When installation is complete, check that all power supply and interconnecting wiring has been appropriately protected.

9-10-3. Refrigerant piping

When refrigerant and drain piping have been completed. Ensure that all pipework is fully insulated and apply finishing tape to seal the insulation.

9-10-4. Check and Test Operation

- Pressure of R410A is approx. 1.6 times of that of R22. If installation work is incompletely finished, a gas leakage may occur at the cases such as pressure rise during operation.
  Therefore, be sure to test the piping connections for leakage.
- Check the flare nut connections, valve stem cap connections and service port cap fittings for gas leak with a leak detector or soap water.

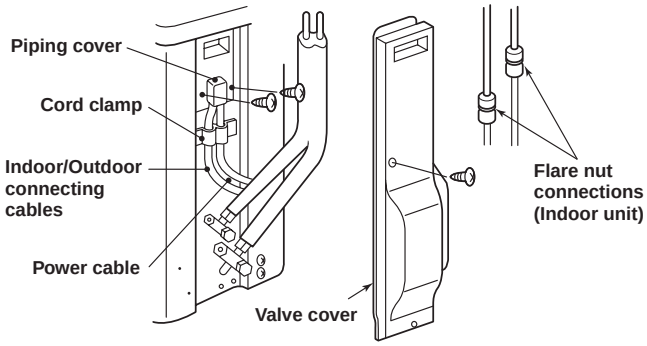


Fig. 9-10-1

9-10-5. Test Operation

To switch the TEST RUN (COOL) mode, press TEMPORARY button for 10 sec.
(The beeper will make a short beep.)

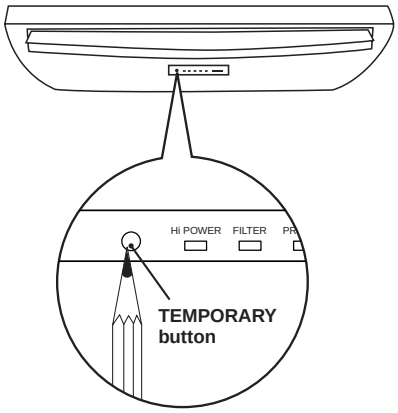


Fig. 9-10-2

9-10-6. Auto Restart Setting

This product is designed so that, after a power failure, it can restart automatically in the same operating mode as before the power failure.

Information

The product was shipped with Auto Restart function in the off position. Turn it on as required.

<How to set the Auto Restart>

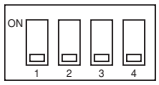
- Press and hold the TEMPORARY button for about 3 seconds. After 3 seconds, the electronic beeper makes three short beeps to tell you the Auto Restart has been selected.
- To cancel the Auto Restart, follow the steps described in the section Auto Restart Function of the Owner's Manual.

9-10-7. Useful Functions (SM800AT-E only)

<Self-Diagnosis by LED Indication>

In addition to the code checking by remote controller of the indoor unit, troubles of the outdoor unit can be diagnosed by LED indications on the cycle control P.C. board of the outdoor unit. Utilize them for various checks.
For the check by remote controller of the indoor unit, refer to the installation Manual of the indoor unit.
Before a check, confirm each bit of the DIP switch is set to OFF position.

LED indication and code checking

DIP switch SW800	Cycle control P.C. board LED indication				Cause
	D800	D801	D802	D803	
	○	●	●	●	Heat exchanger sensor (TE) error
	●	●	○	●	Suction sensor (TS) error
	○	○	●	●	Discharge sensor (TD) error
	●	○	●	○	High-pressure protection error
	●	○	●	●	Outdoor temperature sensor (TO) error
	○	○	○	●	DC outside fan error
	○	●	●	○	Communication error between IPDU
	●	○	○	●	Discharge temp. error
	○	○	●	○	EEPROM error
	●	●	○	○	Communication error between IPDU
	◎	●	●	●	G-Tr short-circuit protection
	●	◎	●	●	Detect circuit error
	◎	◎	●	●	Current sensor error
	●	●	◎	●	Comp. lock error
	◎	●	◎	●	Comp. break down
	●	●	●	◎	Phase missing detection, Detection of coming-off of CT current sensor
	●	○	●	○	Serial communication error by thermo. operation of Comp. case

LED indication

D800 ○ : Red
D801 ○ : Yellow
D802 ○ : Yellow
D803 ○ : Yellow

◎ : Rapid flash
● : Go off
○ : Go on

9-10-8. Installation/Servicing Tools

<Changes in the product and components>

In the case of an air conditioner using R410A, in order to prevent any other refrigerant from being charged accidentally, the service port diameter of the outdoor unit control valve (3 way valve) has been changed. (1/2 UNF 20 threads per inch)

- In order to increase the pressure resisting strength of the refrigerant piping, flare processing diameter and size of opposite side of flare nuts has been changed. (for copper pipes with nominal dimensions 1/2 and 5/8)

New tools for R410A

New tools for R410A	Applicable to R22 model		Changes
Gauge manifold	✕		As pressure is high, it is impossible to measure by means of conventional gauge. In order to prevent any other refrigerant from being charged, each port diameter is changed.
Charge hose	✕		In order to increase pressure resisting strength, hose materials and port size are changed (to 1/2 UNF 20 threads per inch). When purchasing a charge hose, be sure to check the port size.
Electronic balance for refrigerant charging	○		As pressure is hight and gasification speed is fast, it is difficult to read the indicated value by means of charging cylinder, as air bubbles occur.
Torque wrench (nominal diam. 1/2, 5/8)	✕		The size of opposite sides of flare nuts have been increased. Incidentally, a common wrench is used for nominal diameters 1/4 and 3/8.
Flare tool (clutch type)	○		By increasing the clamp bar's receiving hole, strength of spring in the tool has been improved.
Gauge for projection adjustment	——	——	Used when flare is made with using conventional flare tool.
Vacuum pump adapter	○		Connected to the conventional vacuum pump. It is necessary to use an adapter to prevent vacuum pump oil from flowing back to the charge hose. The charge hose connecting part has two ports-one for conventional refrigerant (7/16 UNF 20 threads per inch) and one for R410A. If the vacuum pump oil (mineral) mixes with R410A a sludge may occur and damage the equipment.
Gas leakage detector	✕		Exclusive for HFC refrigerant.

- Incidentally, the "refrigerant cylinder" comes with the refrigerant designation (R410A) and protector coating in the U. S's ARI specified rose color (ARI color code: PMS 507).
- Also, the "charge port and packing for refrigerant cylinder" require 1/2 UNF 20 threads per inch corresponding to the charge hose's port size.

9-11. ENVIRONMENT

9-11-1. Environmental Issues

<Product maintenance>

1. To minimize the chances of environmental damage and to ensure the efficient operation of the unit, it is recommended to have the air conditioner periodically checked and serviced by a qualified engineer.

<Product disposal>

1. Please dispose of the air conditioner unit in an environmentally responsible manner.
   Recycling is the preferred disposal method.
2. When disposing of an air conditioner system, contact either the manufacture, your local environmental control authority or a local waste disposal company for advice.
3. Ensure all packing material is either recycled or disposed of in accordance with local regulations.
4. The refrigerant gas within the unit should only be removed by an authorized company.

⚠ WARNING

Discharge of refrigerant to atmosphere is illegal and may lead to prosecution.

10. TROUBLESHOOTING

10-1. Summary of Troubleshooting

10-1-1. Before troubleshooting

(1) Required tools/instruments
- ⊕ and ⊖ screwdrivers, spanners, radio cutting pliers, nippers, etc.
- Tester, thermometer, pressure gauge, etc.

(2) Confirmation points before check

① The following operations are normal.

a) Compressor does not operate.
- Is not 3-minutes delay (3 minutes after compressor OFF)?
- Does not thermostat turn off?
- Does not timer operate during fan operation?
- Is not outside high-temperature operation controlled in heating operation?

b) Indoor fan does not rotate.
- Does not cool air discharge preventive control work in heating operation?

c) Outdoor fan does not rotate or air volume changes.
- Does not high-temperature release operation control work in heating operation?
- Does not outside low-temperature operation control work in cooling operation?
- Is not defrost operation performed?

d) ON/OFF operation cannot be performed from remote control.
- Is not forced operation performed?
- Is not the control operation performed from outside/remote side?

② Did you return the cabling to the initial positions?

③ Are connecting cables between indoor unit and receiving unit correct?

10-1-2. Troubleshooting procedure

When a trouble occurred, check the parts along with the following procedure.

Trouble → **Confirmation of check code by service mode**

→ **Check defective position and parts.**

NOTE :

For cause of a trouble, power conditions or malfunction/erroneous diagnosis of microcomputer due to outer noise is considered except the items to be checked. If there is any noise source, change the cables of the signal line to shield cables.

10-1-3. Outline of Judgment

A primary judgment to detect cause of error exists on the indoor unit or outdoor unit is performed in the following procedure.

<Judgment by flashing display on the indoor unit display part>

The indoor unit monitors operating status of the air conditioner, and if a protective circuit works, contents of the self-diagnosis are displayed with a block restricted to the following cases on the indoor unit display part (Sensor).

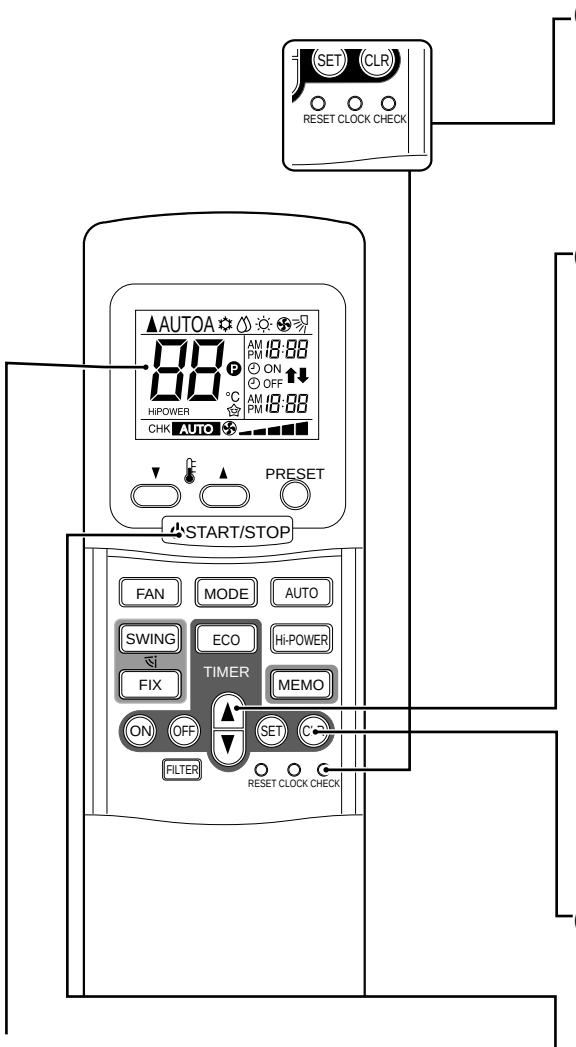
Table 10-1-1

Remote control code	Block display	Contents of self-diagnosis	Check code
—	Operation lamp display flashes. (1Hz)	Power failure (In power ON)	—
00	Operation lamp display flashes. (5Hz)	Indoor P.C. board	0b to 0F, 11, 12, b5, b6
01	Operation/timer lamp displays flash. (5Hz)	Inter-unit cables/transmission system	04
02	Operation/defrost lamp displays flash. (5Hz)	Outdoor P.C. board	14 to 19, 1A, 1C
03	Operation/timer/defrost lamp displays flash. (5Hz)	Cycle system, etc.	1d, 1E, 1F, 21
—	—	—	1b, 8b

10-2. Self-Diagnosis by Remote Control (Check Code)

(1) If the lamps are indicated as shown 00 to 03 in Table 10-1-1, exchanger the self-diagnosis by the remote control.
(2) When the remote control is set to the service mode, the indoor controller diagnoses the operation condition and indicate the information of the self-diagnosis on the display of the remote control with the check codes. If a fault is detected, all lamps on the indoor unit will blink at 5 Hz and it will beep for 10 seconds (Pi, Pi, Pi....). The timer lamp usually blinks (5 Hz) during the self-diagnosis.

10-2-1. How to use remote control in service mode



(1) Press [CHECK] button with a tip of pencil to set the remote control to the service mode.
- "00" is indicated on the display of the remote control.
- The timer lamp on the indoor unit blinks continuously. (5 times per 1 sec.)

(2) Press [TIMER ▲] button.
If there is no fault with a code, the indoor unit will beep once (Pi) and the display of the remote control will change as follows:

→ 00 → 01 → 02 ··· 1d → 1E → 22 —

- Check the unit with all 35 check codes (00 to 22). as shown in Table 10-2-1.
- Press [TIMER ▼] button to change the check code backwards.

If there is a fault, the indoor unit will beep for 10 seconds (Pi, Pi, Pi...).
Note the check code on the display of the remote control.
- 2-digits alphanumeric will be indicated on the display.
- All lamps on the indoor unit will blink. (5 times per 1 sec.)

(3) Press [CLR] button. After service finish for clear service code in memory.
- "7F" is indicated on the display of the remote control.

(4) Press [START/STOP] button to release the service mode.
- The display of the remote control returns to as it was before service mode was engaged.

- Alphanumeric characters are used for the check code.

5	is 5.	6	is 6.
A	is A.	b	is B.
C	is C.	d	is D.

Table 10-2-1

Operation of diagnostic function						Judgement and action
Check code	Block	Check code	Symptom	Unit status	Condition	
00	Indoor P.C. board	0C	The indoor thermo sensor (TA) is defective. Disconnection or short-circuit	Operation continues.	The lamp on the indoor unit blinks when error is defected.	1. Check the indoor thermo sensor (TA). 2. Check the indoor P.C. board.
		0d	The indoor heat exchanger sensor (TC) is defective. Disconnection or short-circuit	Operation continues.	The lamp on the indoor unit blinks when error is defected.	1. Check the indoor heat exchanger sensor (TC). 2. Check the indoor P.C. board.
		11	The indoor fan motor or its circuit is defective.	All off	The lamp on the indoor unit blinks when error is defected.	1. Check the connector circuit of the indoor fan motor (CN10). 2. Check the indoor fan motor. 3. Check the indoor P.C. board.
		12	The part other than the above parts on the indoor P.C. board is defective. EEPROM access error	Operation continues.	The lamp on the indoor unit blinks when error is defected.	1. Check the indoor P.C. board. (EEPROM and peripheral circuits)
		21	IOL operation	All off	The lamp on the indoor unit blinks when error is defected.	Overload operation of refrigerating cycle
	The block is unidentifiable	13	The variation of TC, 5 minutes after starting the compressor, is 2K or less.	Operation continues.	The lamp on the indoor unit blinks when error is defected.	1. Check whether or not the TC sensor comes off. 2. Check whether or not it is possible to operate the compressor and the outdoor fan motor. 3. Check gas leak.
01	Cable connection	04	The serial signals can not be transmitted and received between indoor and outdoor units. • The crossover wire is connected wrongly. • The serial signal transmitting circuit on the outdoor P.C. board is defective. • The serial signal receiving circuit on the indoor P.C. board is defective.	Operation continues.	The lamp on the indoor unit blinks when error is defected.	1. In the case of the outdoor unit not operating at all; • Check the crossover cable and connect it properly. • Check the outdoor P.C. board. 2. In the case of the outdoor unit operating normally; • Check whether or not both of serial LED (Green) and serial LED (Orange) is blinking. If the serial LED (Green) is not blinking, check the outdoor P.C. board. If the serial LED (Orange) is not blinking, check the indoor P.C. board.
		05	The operation command signals are not transmitted from the indoor unit to the outdoor unit.	Operation continues.	The lamp on the indoor unit blinks when error is defected. And it returns to the normal condition when recovering from errors.	If the operation command signals continue to be transmitted between ② and ③ of the indoor terminal block, replace the outdoor P.C. board.
02	Outdoor P.C. board	18	The outdoor thermo sensor (TE) is defective. Disconnection or short-circuit	All off	The lamp on the indoor unit blinks when error is defected.	1. Check the outdoor thermo sensor (TE). 2. Check the outdoor P.C. board.
		19	The outdoor heat exchanger (TD) sensor is defective. Disconnection or short-circuit	All off	The lamp on the indoor unit blinks when error is defected.	1. Check the outdoor heat exchanger sensor (TD). 2. Check the outdoor P.C. board.
03	Other parts (including compressor)	07	The reply serial signal has been transmitted when starting the unit, but stops being transmitted shortly after. 1. Compressor thermo operation • Gas shortage • Gas leak 2. Instantaneous power failure	Operation continues.	The lamp on the indoor unit blinks when error is defected. And it returns to the normal condition when recovering from errors.	1. Repeatedly turn the indoor unit on and off with the interval of approx. 10 to 40 minutes. (The check code is not indicated during operation.) And supply gas. (Check gas leak.) 2. The indoor unit operates normally during the check. If the reply serial signal continues to be transmitted between ② and ③ of the indoor terminal block, replace the outdoor P.C. board. If the signal stops between them, replace the indoor P.C. board.
		1E	The discharge temperature is over 120°C.	All off	The lamp on the indoor unit blinks when error is defected.	1. Check the heat exchanger sensor (TD). 2. Gas purging
		20	The IOL operation is defective.	All off	The lamp on the indoor unit blinks when error is detected.	When turning on the unit, the normal phase (RST) is detected but T-R waveform has not been detected for 120 seconds or more.

Table 10-2-2

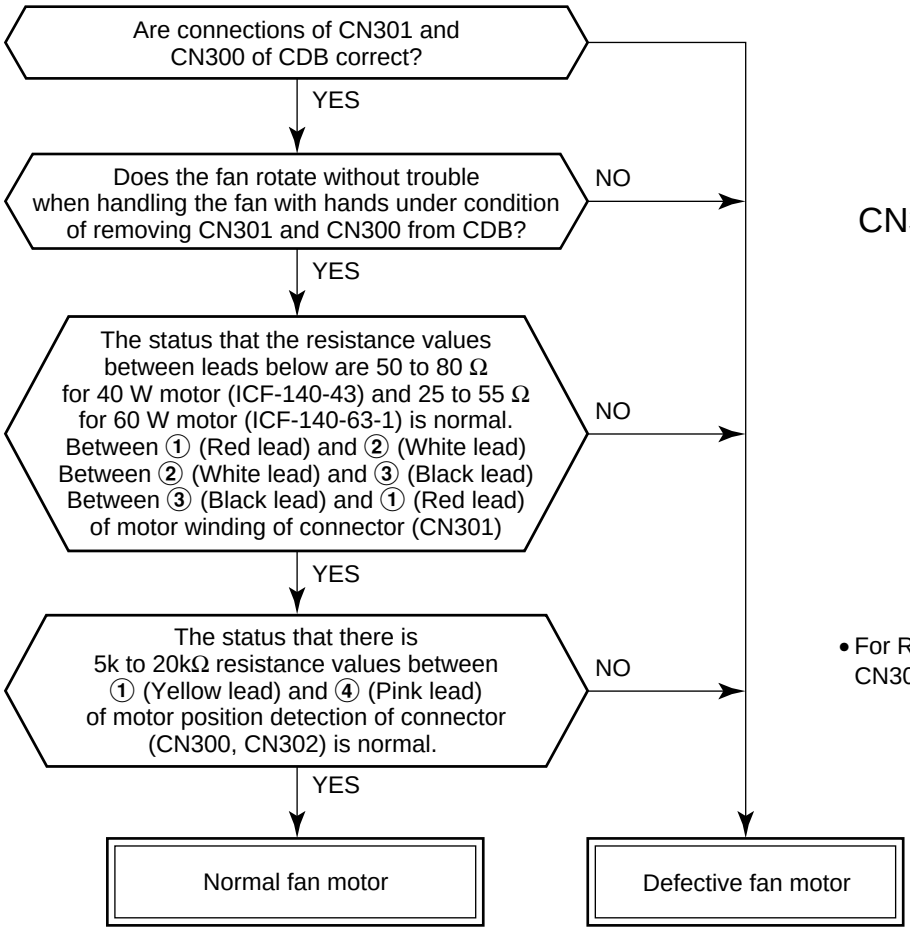
Operation of diagnostic function					Judgement and action
Block	**Check code**	**Symptom**	**Unit status**	**Condition**	
[MODE] [TIMER] lamp 5Hz flash	04	The serial signal is not output from outdoor unit to indoor unit. • Miscabling of inter-unit cables • Defective serial sending circuit on outdoor P.C. board • Defective serial receiving circuit on outdoor P.C. board • Compressor case thermo operation	Operation continues.	Displayed when error is detected	1. Outdoor unit does not completely operate. • Inter-unit cable check, correction of miscabling • Outdoor P.C. board check, P.C. board cables check • Compressor case thermo check 2. In normal operation When outdoor sending serial LED (Green) flashes, the receiving serial LED (Orange) also flashes. : Indoor P.C. board (Main P.C. board) check When the receiving serial LED (Orange) does not flash: Outdoor P.C. board check
	97	BUS communication circuit error * BUS communication was interrupted over the specified time.	Operation continues (According to remote control of indoor unit)	Displayed when error is detected	1. Communication line check, miscabling check Power supply check for central control (Central control remote control, etc.) and indoor unit 2. Communication check (XY terminal) 3. Indoor P.C. board check 4. Central control check (Communication P.C. board)
	08	Error in 4-way valve system • Indoor heat exchanger temperature rise after start of cooling operation. • Indoor heat exchanger temperature fall after start of heating operation.	Operation continues.	Displayed when error is detected	1. Check 4-way valve. 2. Check 2-way valve and non-return valve. 3. Check indoor heat exchanger sensor (TC). 4. Check indoor P.C. board (Main P.C. board).
	09 *	Error in other cycles • Indoor heat exchanger temp (TC) does not vary after start of cooling/ heating operation.	Operation continues.	Displayed when error is detected	1. Compressor case thermo operation. 2. Coming-off of detection part of indoor heat exchanger sensor. 3. Check indoor heat exchanger sensor (TC). 4. Check indoor P.C. board (Main P.C. board).
[MODE] lamp 5Hz flash	0C	Coming-off, disconnection or short of indoor temp sensor (TA)	Operation continues.	Displayed when error is detected	1. Check indoor temp sensor (TA). 2. Check indoor P.C. board (Main P.C. board).
	0d	Coming-off, disconnection or short of indoor temp sensor (TC)	Operation continues.	Displayed when error is detected	1. Check indoor temp sensor (TC). 2. Check indoor P.C. board (Main P.C. board).
	0F	Coming-off, disconnection or short of indoor temp sensor (TCJ)	Operation continues.	Displayed when error is detected	1. Check indoor temp sensor (TCJ). 2. Check indoor P.C. board (Main P.C. board).
[MODE] lamp 5Hz flash	11	Error in indoor fan system Revolutions frequency error of fan	All stop	Displayed when error is detected	1. Check indoor fan motor connector circuit (CN210). 2. Check indoor fan. 3. Check indoor P.C. board (Main P.C. board).
	12	Error in indoor unit or other positions 1. EEPROM access error	Operation continues.	Displayed when error is detected	1. Check indoor P.C. board (EEPROM and peripheral circuits) (Main P.C. board).
	b5	Outside error input Detected by input voltage level from outside devices	Operation continues.	Displayed when error is detected	1. Check outside devices. 2. Check indoor P.C. board (Main P.C. board).
	b6	Outside interlock input Detected by input voltage level from outside devices	All stop	Displayed when error is detected	

*: No display in the setting at shipment

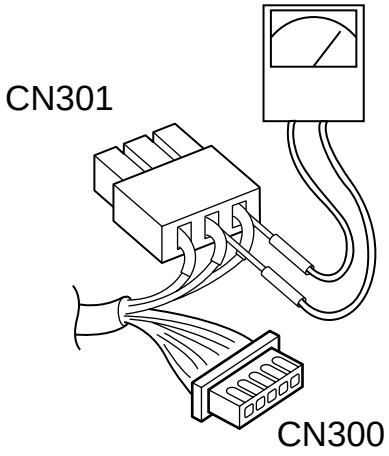
Table 10-2-3

Operation of diagnostic function				Judgement and action
Check code	**Symptom**	**Unit status**	**Condition**	
14	Inverter over-current protective circuit operates. (For a short time)	All stop	Displayed when error is detected	1. Inverter immediately stops even if restarted. • Compressor rare short 2. Check IPDU. • Cabling error
17	Error on current detection circuit • Current value is high at AC side even while compressor stops. • Phase of power supply is missed.	All stop	Displayed when error is detected	1. Compressor immediately stops even if restarted. : Check IPDU. 2. Phase-missing operation of power supply • Check power voltage of R, S, T.
18	Coming-off, disconnection or short of outdoor temp sensor	All stop	Displayed when error is detected	1. Check outdoor temp sensor (TE, TS). 2. Check CDB.
19	Coming-off, disconnection or short of outdoor temp sensor	All stop	Displayed when error is detected	1. Check outdoor temp sensor (TD). 2. Check CDB.
1C	Compressor drive output error • Tin thermistor temp, Tin error (IPDU heat sink temp. is high.) Communication error between IPDU • Connector coming-off between CDB and IPDU	All stop	Displayed when error is detected	1. Abnormal overload operation of refrigerating cycle 2. Loosening of screws and contact error of IPDU and heat sink 3. Cooling error of heat sink 4. Check cabling of CDB and IPDU.
1d	Compressor does not rotate. (Over-current protective circuit works when constant time passed after activation of compressor.)	All stop	Displayed when error is detected	1. Compressor error (Compressor lock, etc.) : Replace compressor. 2. Cabling trouble of compressor (Phase missing)
1E	Discharge temp error • Discharge temp over specified value was detected.	All stop	Displayed when error is detected	1. Check refrigerating cycle. (Gas leak) 2. Error of electron control valve 3. Check pipe sensor (TD).
1F	Compressor breakdown • Operation frequency lowered and stops though operation had started.	All stop	Displayed when error is detected	1. Check power voltage. (AC200V±20V) 2. Overload operation of refrigerating cycle 3. Check current detection circuit at AC side.
21	High-voltage protection error by TE sensor • TE temp over specified value was detected.	All stop	Displayed when error is detected	1. Overload operation of refrigerating cycle 2. Check outdoor temp sensor (TE).
1A	DC outdoor fan motor error • IDC operation or lock was detected by DC outdoor fan driving.	All stop	Displayed when error is detected	1. Position detection error 2. Over-current protection circuit operation of outdoor fan drive unit • Check CDB. • Refer to Judgment of outdoor fan.
16	Error on IPDU position detection circuit	All stop	Displayed when error is detected	1. Position detection circuit operates even if driving by removing 3P connector of compressor. • Replace IPDU.
1b	Coming-off, disconnection or short of outdoor temp sensor	Operation continues.	Displayed when error is detected	1. Check outdoor temp sensor (TO). 2. Check P.C. board.

10-3. Troubleshooting for Each Check Code
[1A error]


Are connections of CN301 and CN300 of CDB correct?
YES
Does the fan rotate without trouble when handling the fan with hands under condition of removing CN301 and CN300 from CDB?
NO
YES
The status that the resistance values between leads below are 50 to 80 Ω for 40 W motor (ICF-140-43) and 25 to 55 Ω for 60 W motor (ICF-140-63-1) is normal.
Between ① (Red lead) and ② (White lead)
Between ② (White lead) and ③ (Black lead)
Between ③ (Black lead) and ① (Red lead)
of motor winding of connector (CN301)
NO
YES
The status that there is 5k to 20kΩ resistance values between ① (Yellow lead) and ④ (Pink lead) of motor position detection of connector (CN300, CN302) is normal.
NO
YES
Normal fan motor
Defective fan motor

(CDB error)



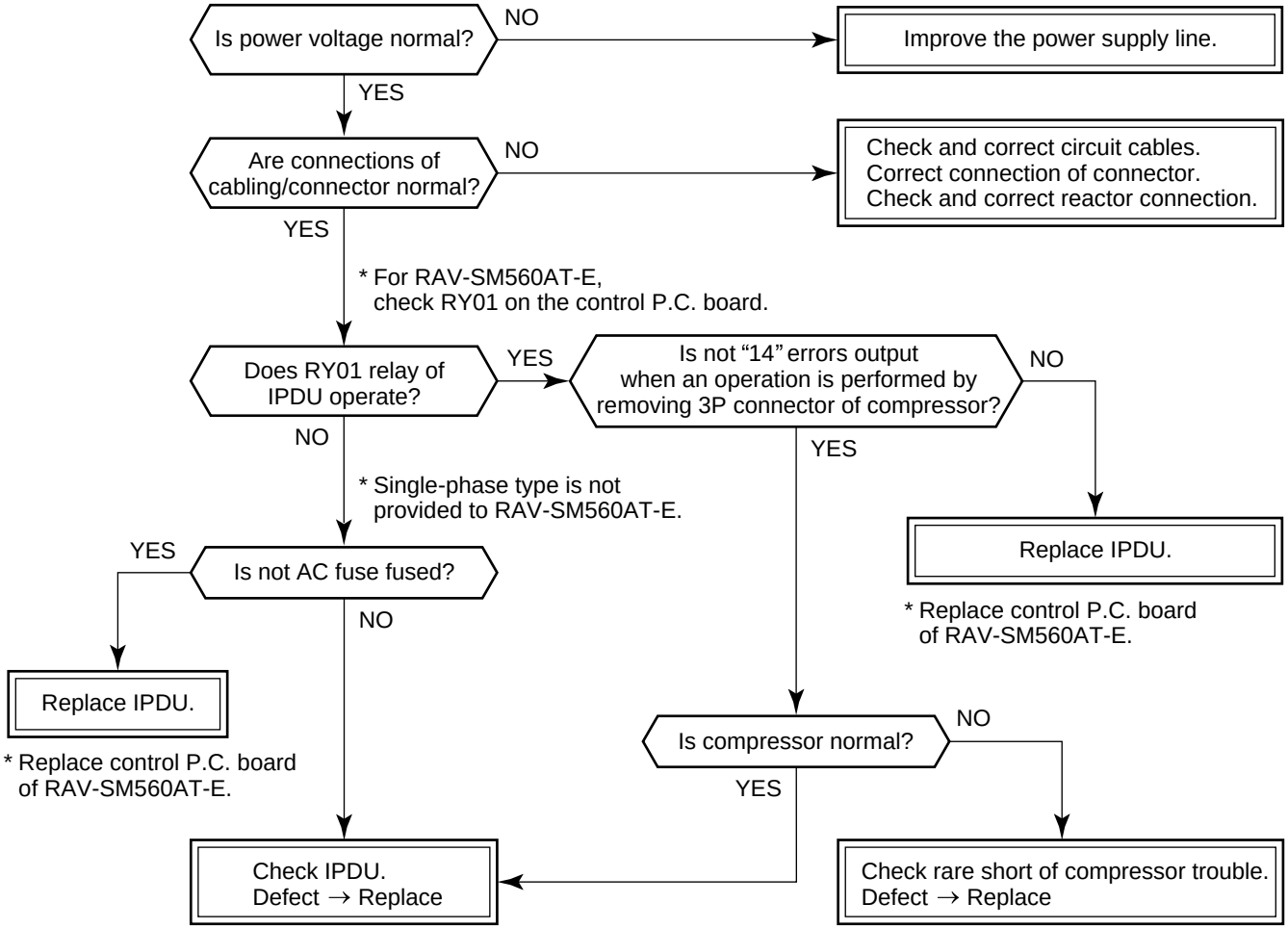
- For RAV-SM560AT-E, CN300 changes to CN301, and CN301 to CN300, respectively.

NOTE :

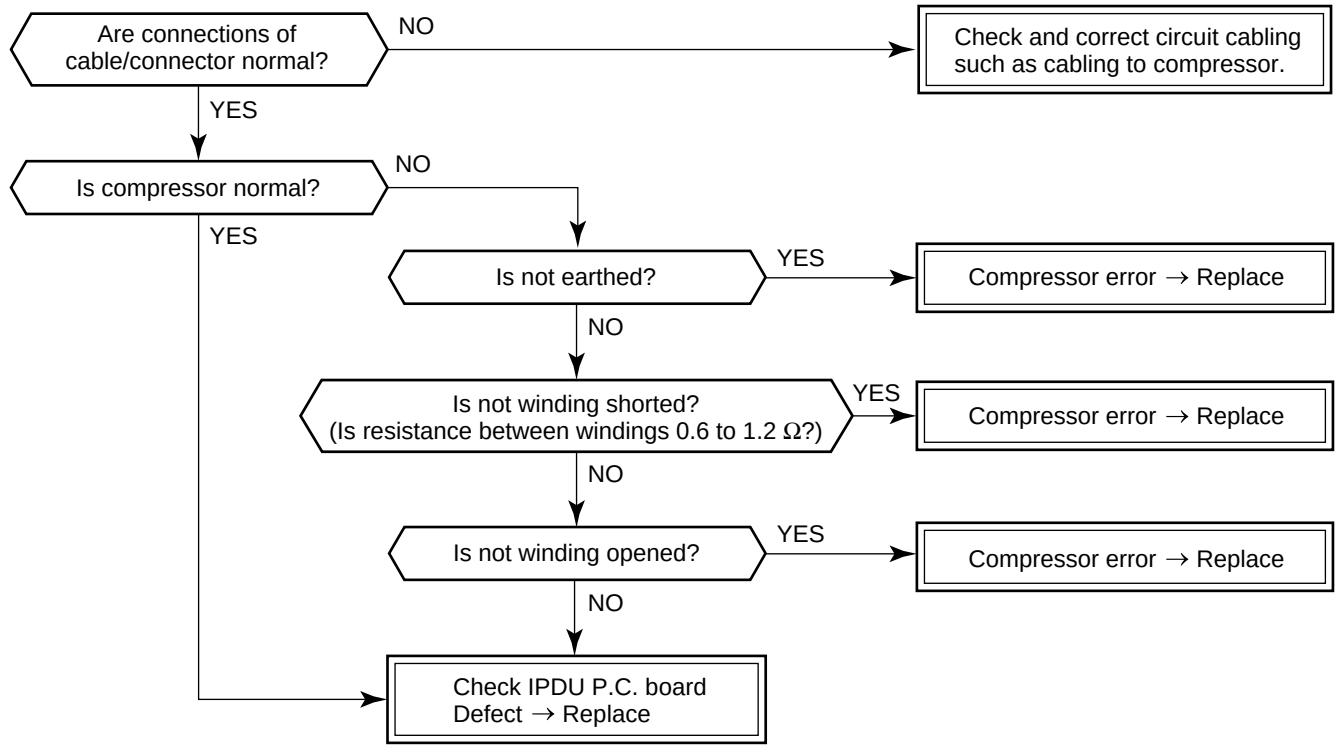
However, GND circuit error inside of the motor is rarely detected even if the above check is carried out. When the circuit does not become normal even if P.C. board has been replaced, replace outdoor fan motor.

	RAV-SM560AT-E	**RAV-SM800AT-E**
Objective P.C. board	Control P.C. board	CDB P.C. board
Fan motor winding	CN300	CN301
Motor position detection	CN301	CN300

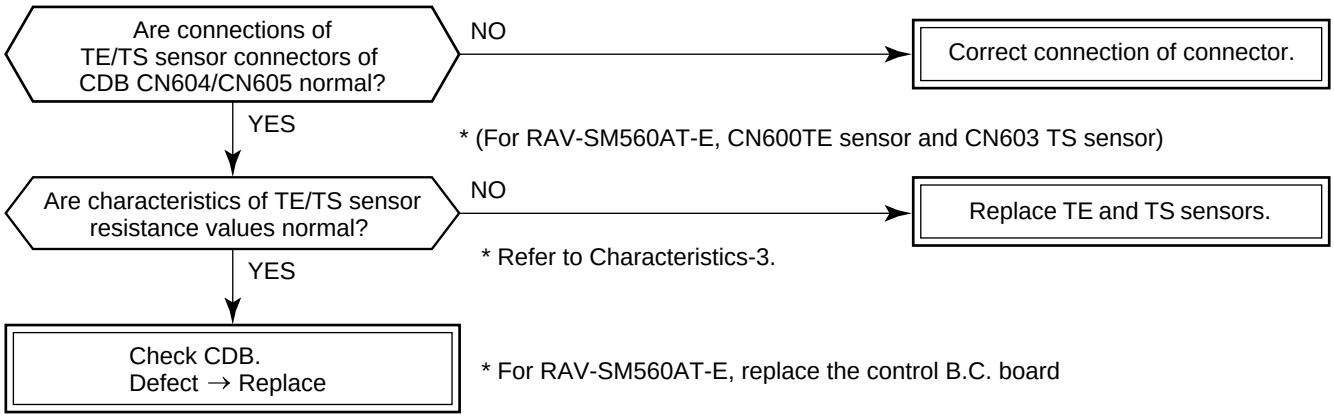
[14 error]



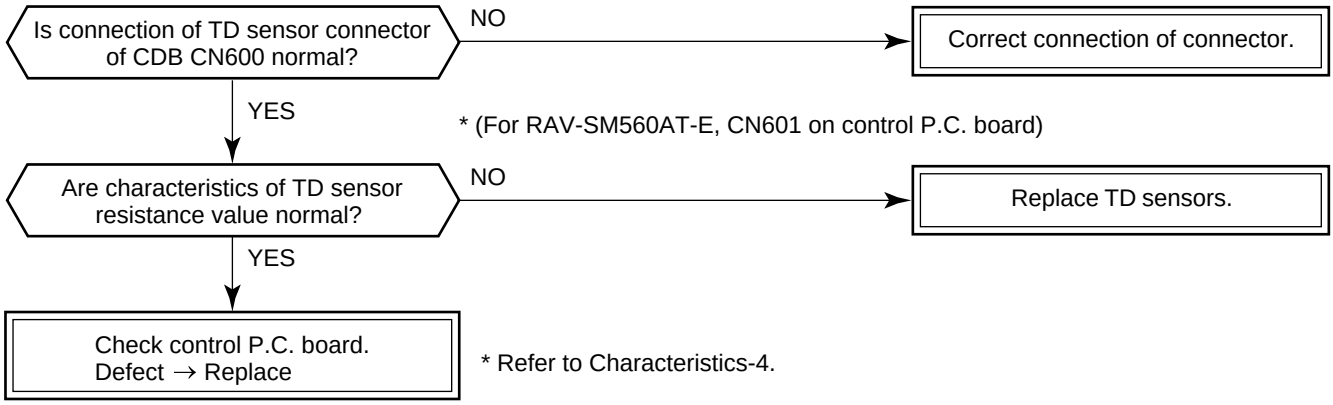
[16 error]



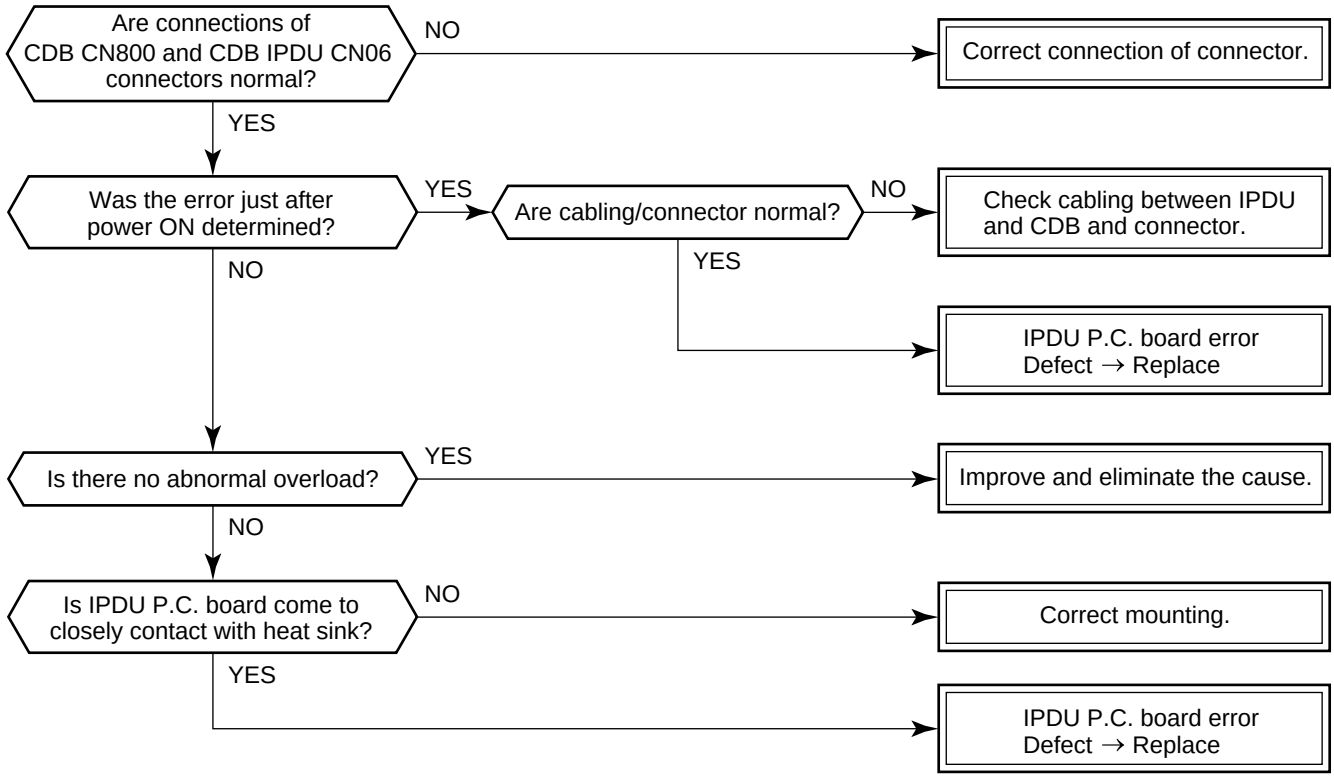
[18 error]


Are connections of TE/TS sensor connectors of CDB CN604/CN605 normal?
NO
Correct connection of connector.
YES
* (For RAV-SM560AT-E, CN600TE sensor and CN603 TS sensor)
Are characteristics of TE/TS sensor resistance values normal?
NO
Replace TE and TS sensors.
* Refer to Characteristics-3.
YES
Check CDB.
Defect → Replace
* For RAV-SM560AT-E, replace the control B.C. board

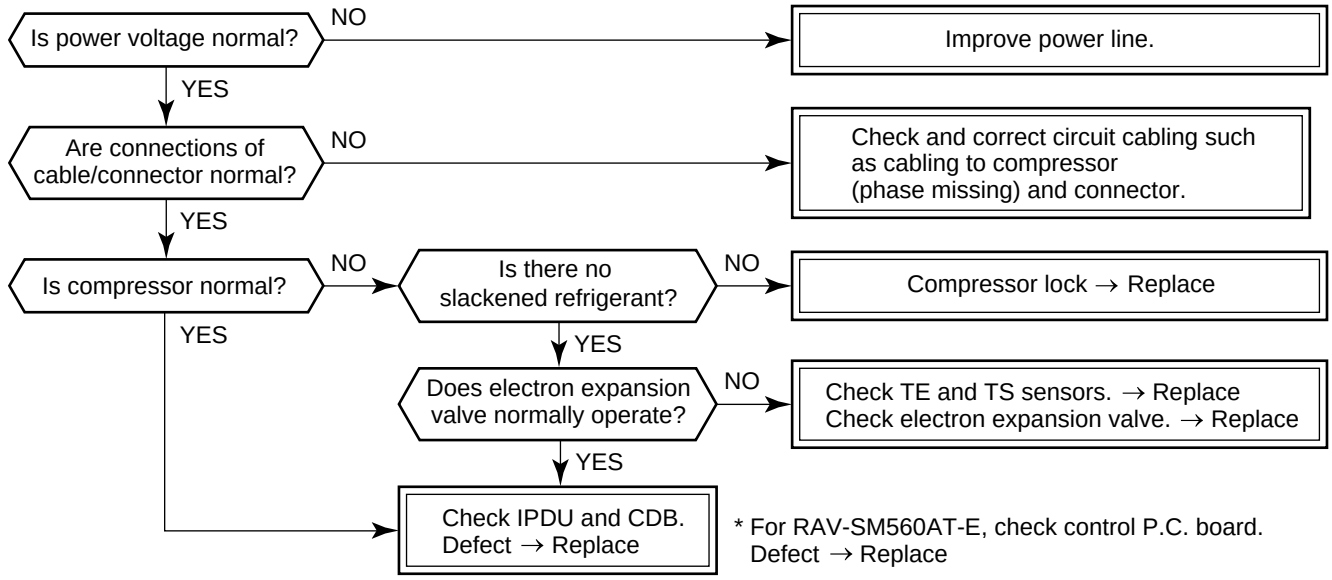
[19 error]


Is connection of TD sensor connector of CDB CN600 normal?
NO
Correct connection of connector.
YES
* (For RAV-SM560AT-E, CN601 on control P.C. board)
Are characteristics of TD sensor resistance value normal?
NO
Replace TD sensors.
YES
Check control P.C. board.
Defect → Replace
* Refer to Characteristics-4.

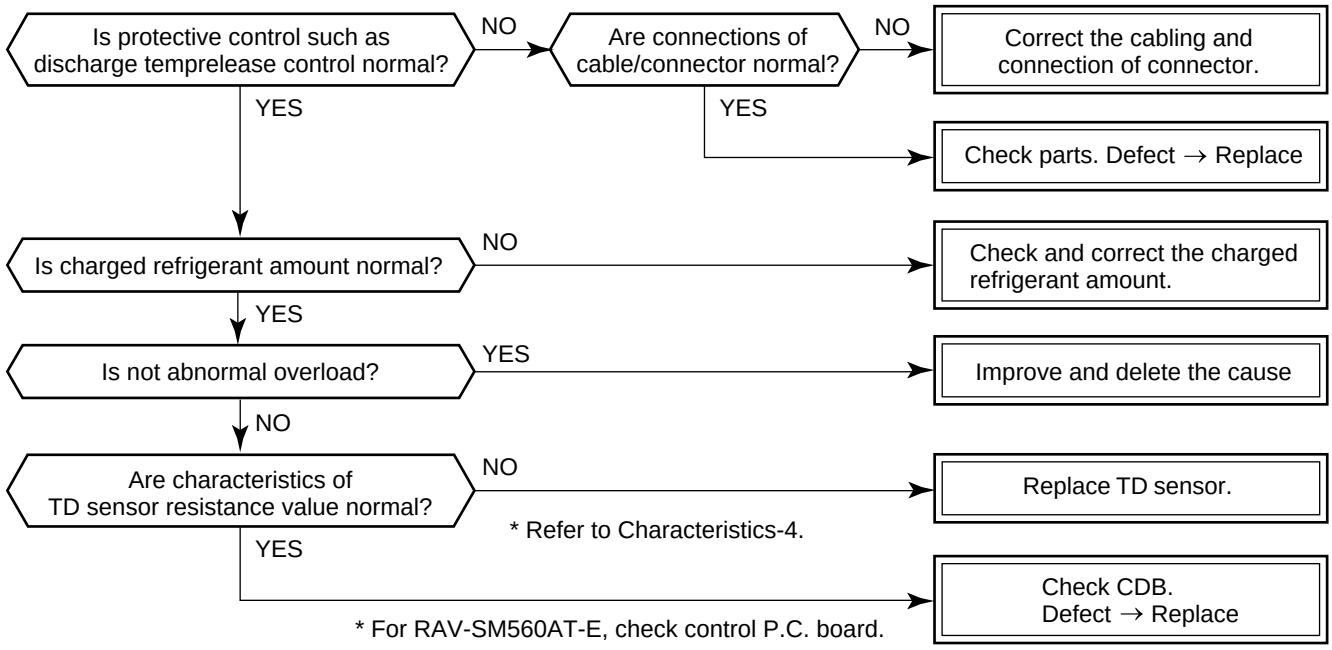
[1C error]* Except RAV-SM560AT-E



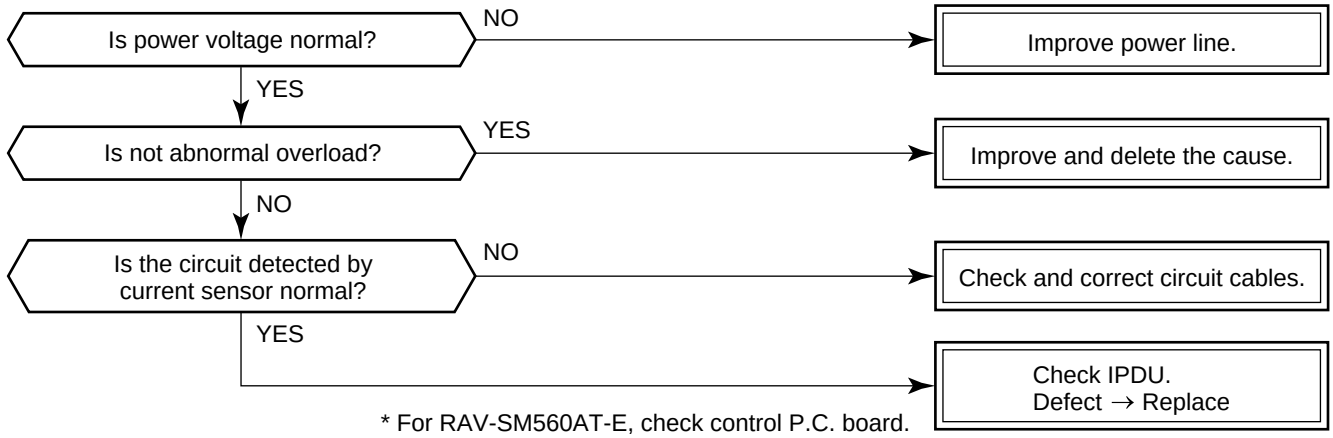
[1D error]



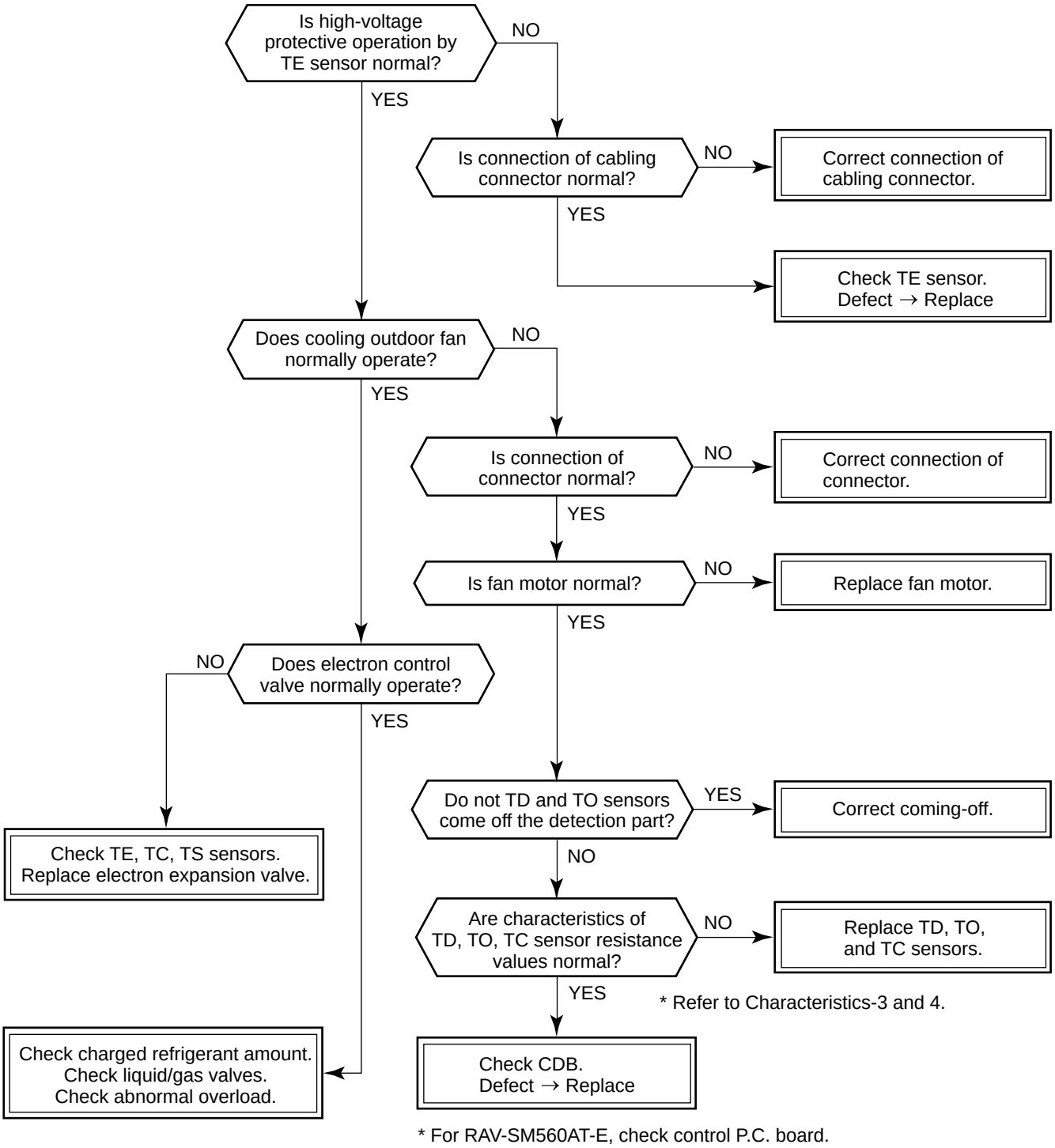
[1E error]



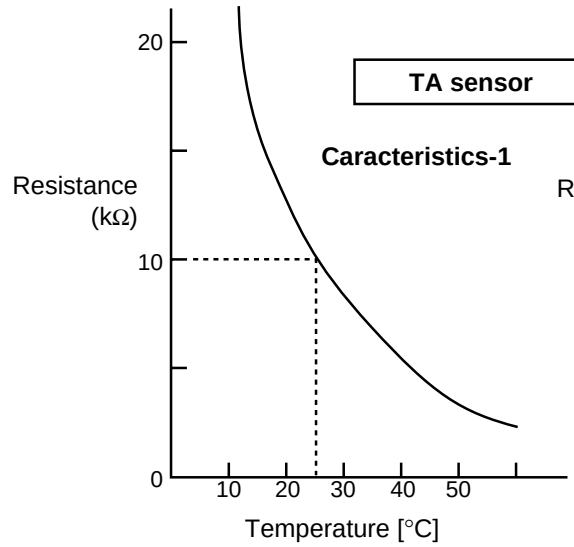
[1F error]

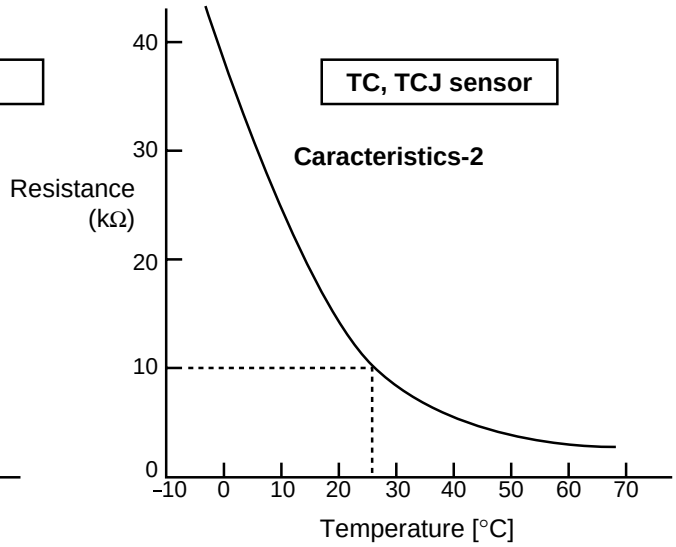


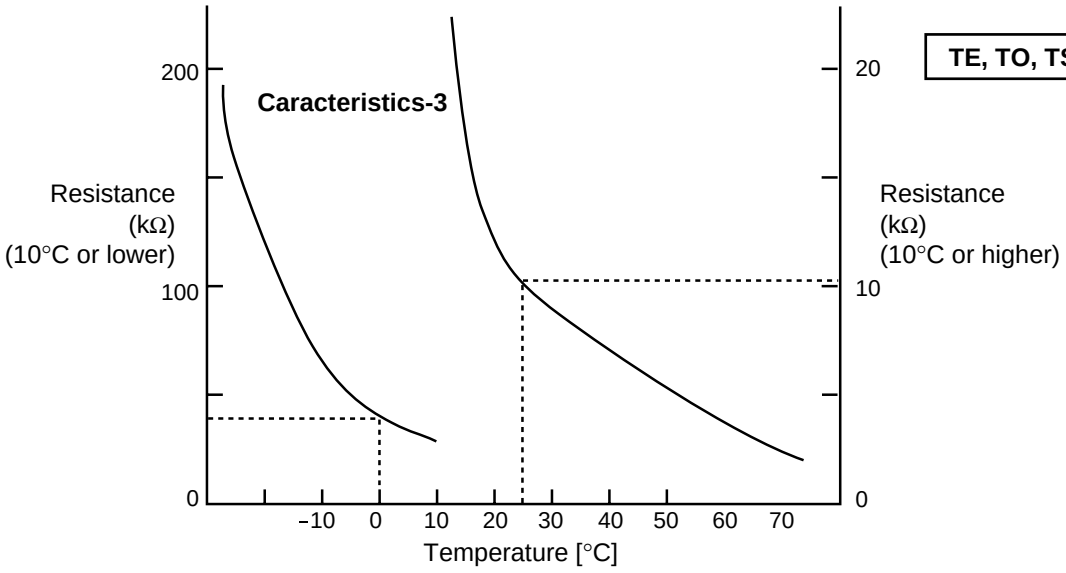
[21 error]

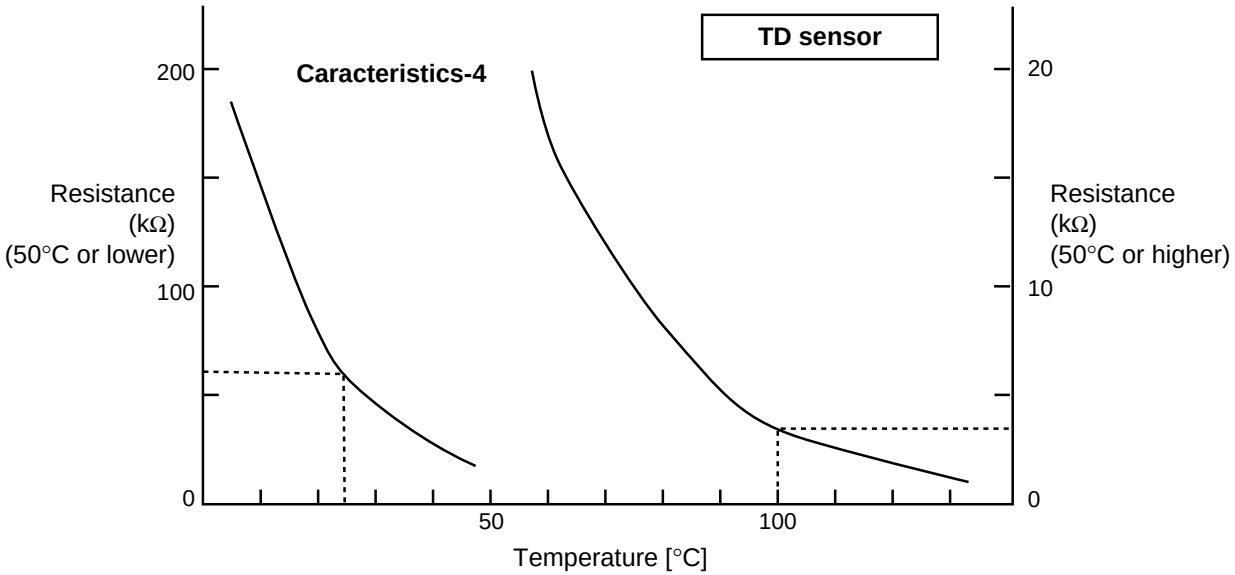

Is high-voltage protective operation by TE sensor normal?
NO
YES
Is connection of cabling connector normal?
NO
Correct connection of cabling connector.
YES
Check TE sensor. Defect → Replace
Does cooling outdoor fan normally operate?
NO
YES
Is connection of connector normal?
NO
Correct connection of connector.
YES
Is fan motor normal?
NO
Replace fan motor.
YES
NO
Does electron control valve normally operate?
YES
Check TE, TC, TS sensors. Replace electron expansion valve.
Do not TD and TO sensors come off the detection part?
YES
Correct coming-off.
NO
Are characteristics of TD, TO, TC sensor resistance values normal?
NO
Replace TD, TO, and TC sensors.
YES
* Refer to Characteristics-3 and 4.
Check charged refrigerant amount. Check liquid/gas valves. Check abnormal overload.
Check CDB. Defect → Replace
* For RAV-SM560AT-E, check control P.C. board.

Relational graph of temperature sensor resistance value and temperature









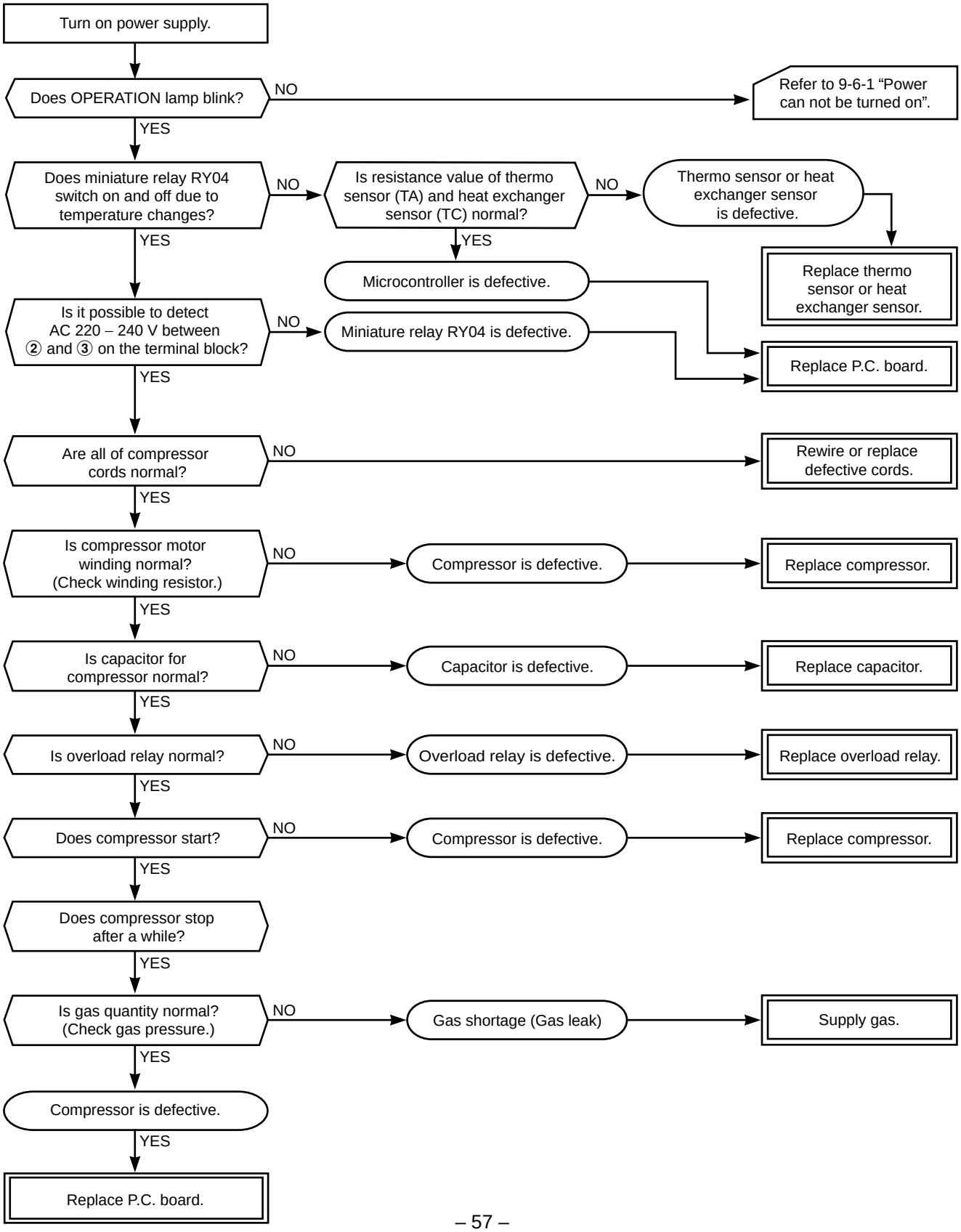
10-4 Compressor does not operate.

<Primary check>

(1) Is the preset temperature higher than the room temperature in cooling operation?
(2) Is the crossover cable connected properly?

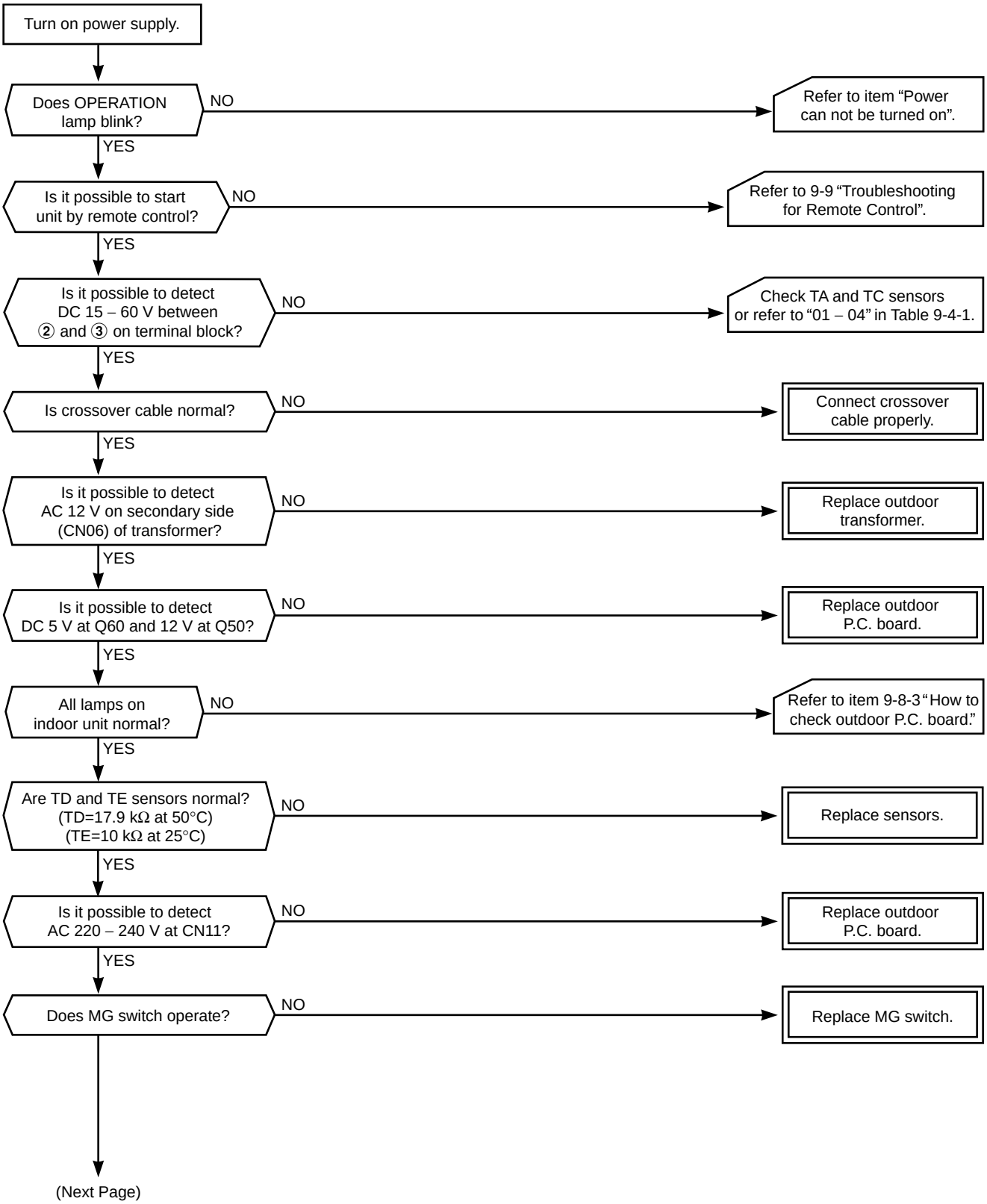
<Inspection procedure>

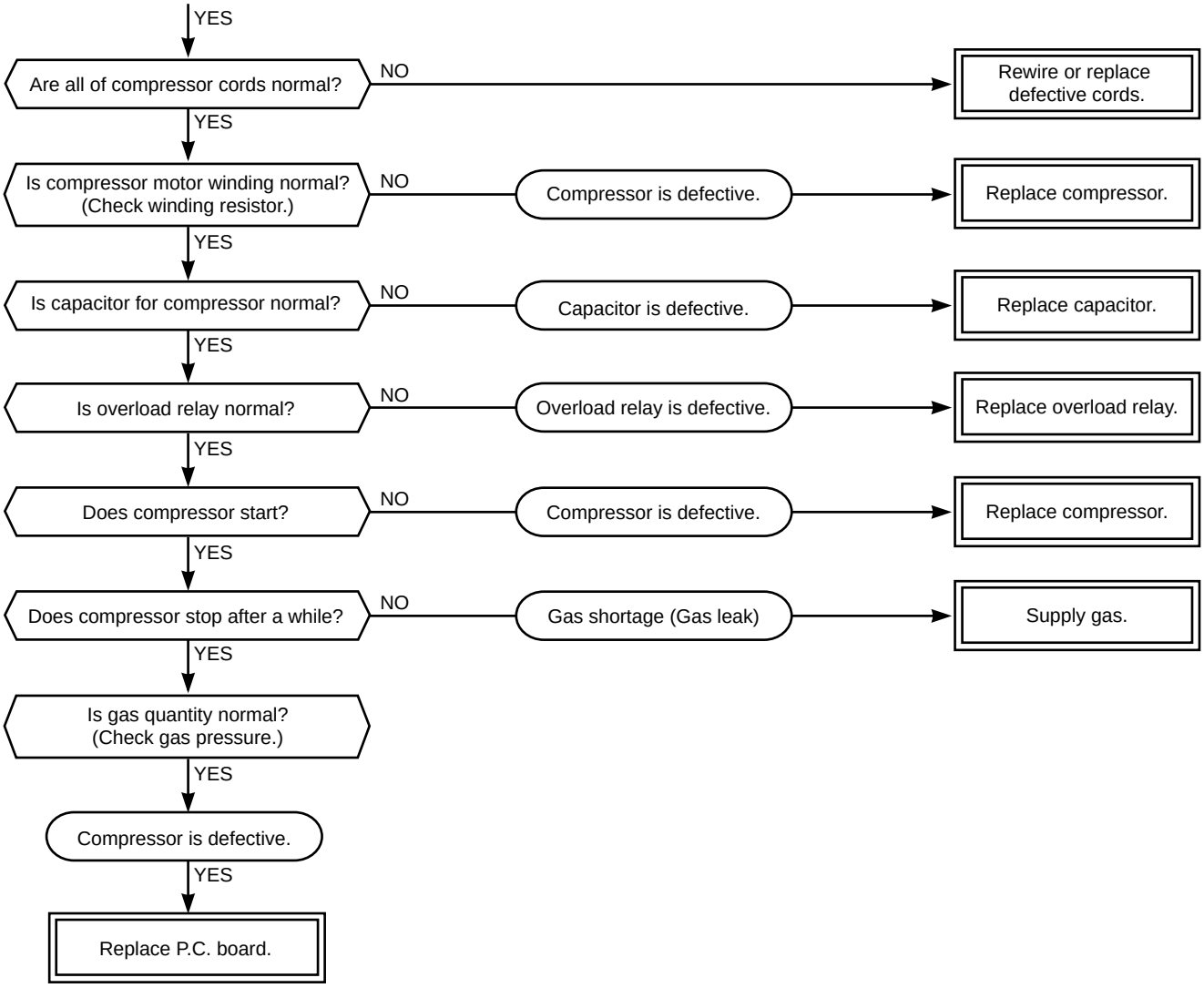
-Cooling only model-



<Inspection procedure>

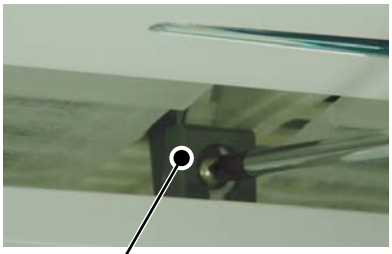
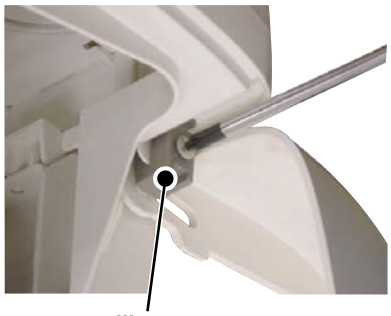
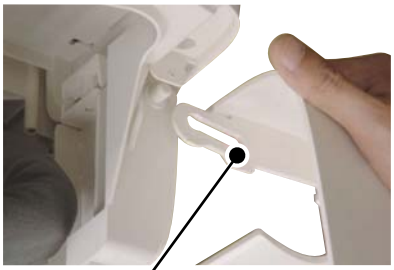
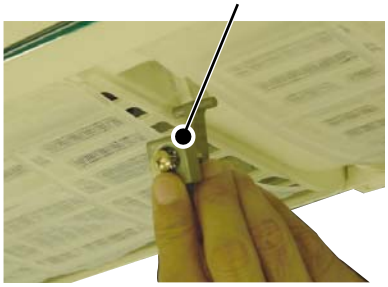
-Cooling and heating model-

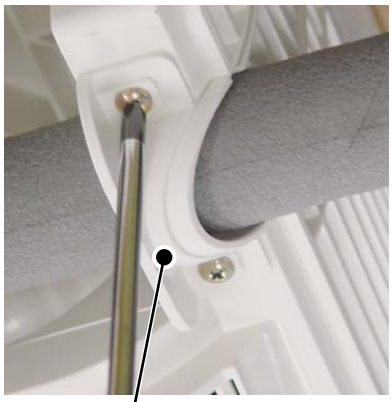
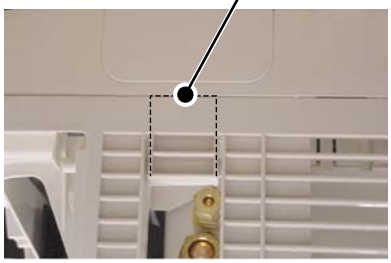
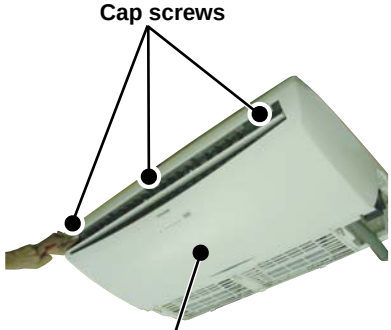
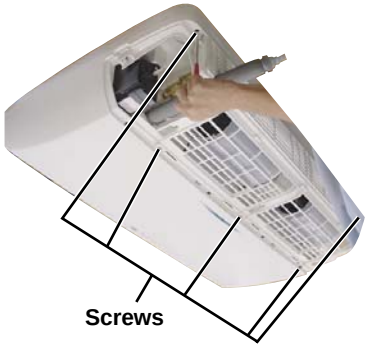

Turn on power supply.
Does OPERATION lamp blink?
NO
Refer to item “Power can not be turned on”.
YES
Is it possible to start unit by remote control?
NO
Refer to 9-9 “Troubleshooting for Remote Control”.
YES
Is it possible to detect DC 15 – 60 V between ② and ③ on terminal block?
NO
Check TA and TC sensors or refer to “01 – 04” in Table 9-4-1.
YES
Is crossover cable normal?
NO
Connect crossover cable properly.
YES
Is it possible to detect AC 12 V on secondary side (CN06) of transformer?
NO
Replace outdoor transformer.
YES
Is it possible to detect DC 5 V at Q60 and 12 V at Q50?
NO
Replace outdoor P.C. board.
YES
All lamps on indoor unit normal?
NO
Refer to item 9-8-3 “How to check outdoor P.C. board.”
YES
Are TD and TE sensors normal? (TD=17.9 kΩ at 50°C) (TE=10 kΩ at 25°C)
NO
Replace sensors.
YES
Is it possible to detect AC 220 – 240 V at CN11?
NO
Replace outdoor P.C. board.
YES
Does MG switch operate?
NO
Replace MG switch.
(Next Page)

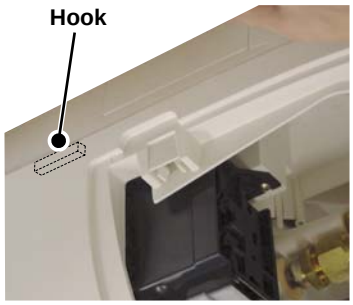
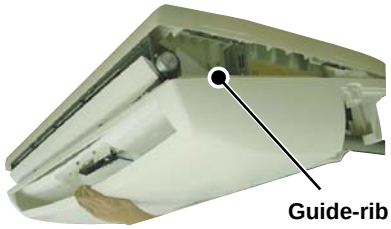
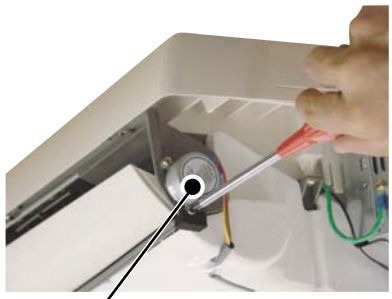
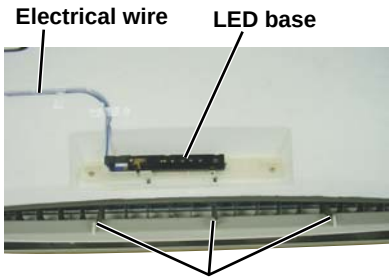
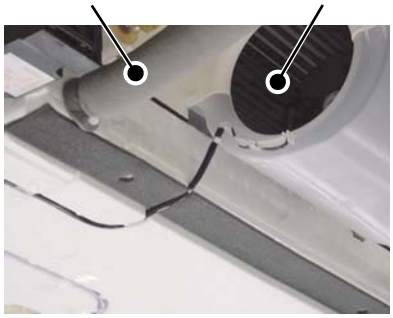

YES
Are all of compressor cords normal?
NO
Rewire or replace defective cords.
YES
Is compressor motor winding normal? (Check winding resistor.)
NO
Compressor is defective.
Replace compressor.
YES
Is capacitor for compressor normal?
NO
Capacitor is defective.
Replace capacitor.
YES
Is overload relay normal?
NO
Overload relay is defective.
Replace overload relay.
YES
Does compressor start?
NO
Compressor is defective.
Replace compressor.
YES
Does compressor stop after a while?
NO
Gas shortage (Gas leak)
Supply gas.
YES
Is gas quantity normal? (Check gas pressure.)
YES
Compressor is defective.
YES
Replace P.C. board.

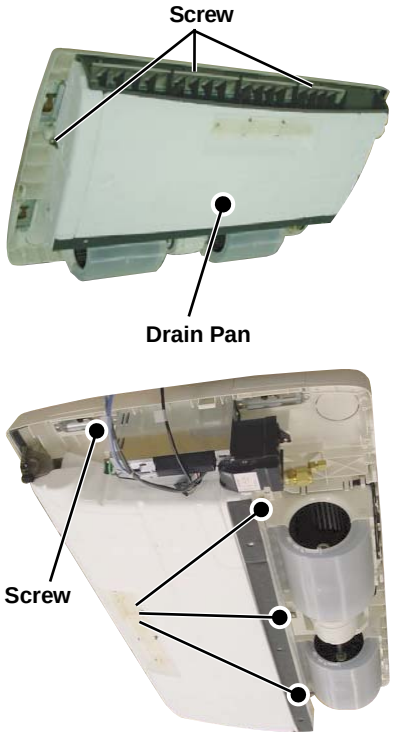
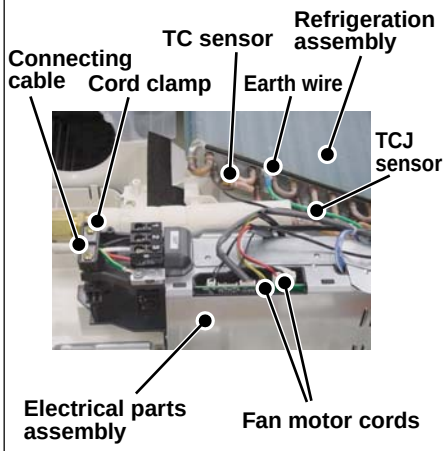
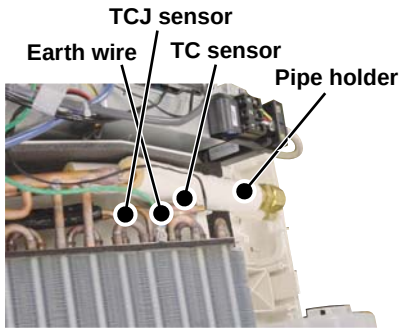
11. DETACHMENTS

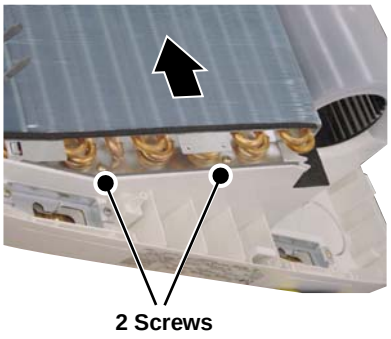
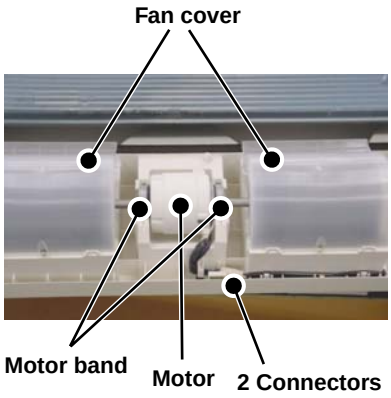
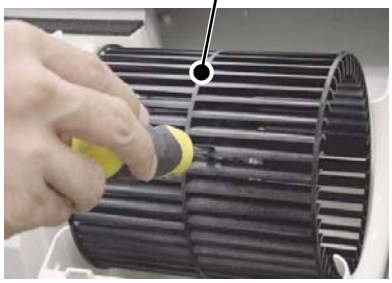
11-1. Indoor Unit

No.	Part name	Procedures	Remarks
①	Air Inlet grille	**<How to remove the Air inlet grille>** 1) Stop the operation of the Air conditioner and turn off its main power supply. 2) Open the Air inlet grille with both hands.	 **Air inlet grille**
		3) Unfasten 3 screws (about two to three rounds) for fixing the Panel arms. 4) Move the Air inlet grille toward.	 **Panel arm**
		5) Remove the Grille stopper from the axis of the Front panel. After that, remove the Air inlet grille.	 **Grille stopper**
		6) Remove the Panel arms from the Front panel. **<How to install the Air inlet grille>** 1) Insert three Panel arms on the Air inlet grille and fix each securely by screws. 2) Set the Air inlet grille arm to the axis of the Front panel. 3) Insert the Grille stopper to the correct position and fix it securely with screws. 4) Push the Air inlet grille to the correct position.	 **Air inlet grille** **Panel arm** 

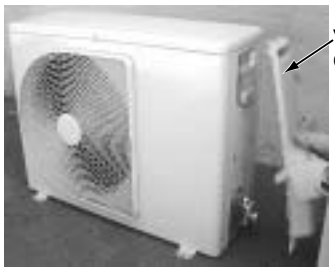
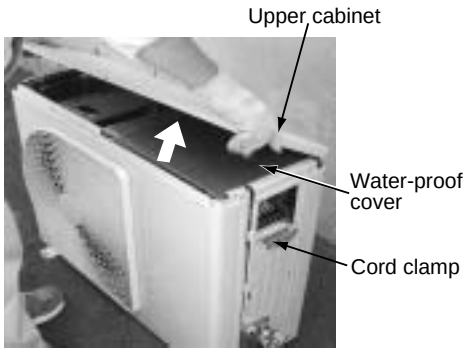
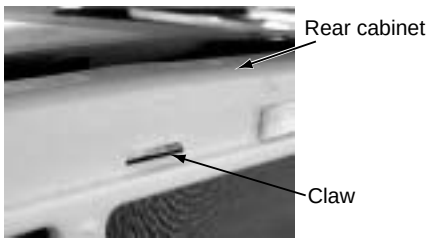
No.	Part name	Procedures	Remarks
②	Front panel	**<How to remove the Front panel>** 1) Remove the Air inlet grille. (①) 2) In case of the Drain hose is installed through the Front panel. : Remove the Drain band from the Front panel. : Cut away the Opening base for piping from Front panel and keep parts.	 Drain band Drain panel 
		3) Open 3 Cap screws and remove the screws.	Cap screws  Front Panel
		4) Remove 5 screws fixing the Front panel.	 Screws
		5) Remove the hooks of the Panel LED nearly side from the Drain pan.	
		(Continue)	

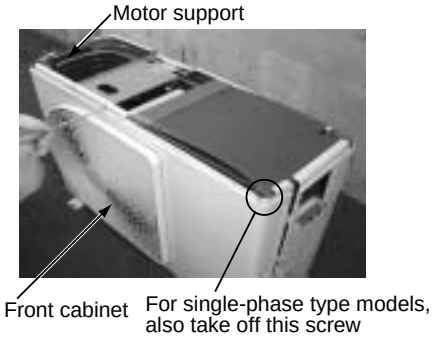
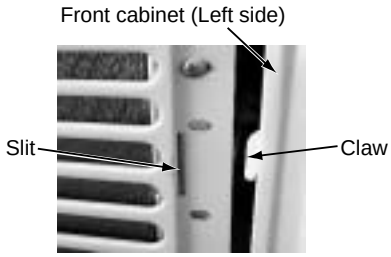
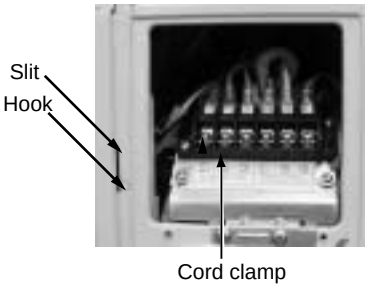
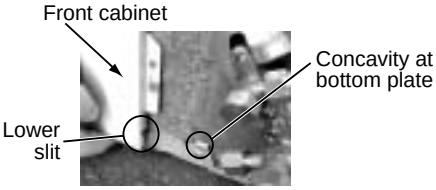
No.	Part name	Procedures	Remarks
②	Front panel	6) Remove both side hooks and remove the Front panel by turn to air inlet part direction. **<How to install the Front panel>** 1) In case of the Drain hose installation through the Front panel, install the opening base for piping in the Back body by a screw (M4 x 12). Prepare it by yourself. 2) Fit the Front panel in the Drain pan. Then fix it in the Drain pan with 2 hooks in the center of the air outlet. 3) Fix 5 hooks around the Front panel with conformation the Guide-rib is inserting into the Back body. 4) Fix 8 screws and close 3 Cap screws. 5) Install the Drain band into the Front panel. 6) Check the gap between the Front panel and the Back body.	 
③	Drain pan assembly	**<How to remove the Drain pan>** 1) Remove the Air inlet grille and the Front panel. (①, ②) 2) Remove the Louver motor from the Drain pan. 3) Remove the shaft of Horizontal louver. 4) Remove the LED base and Electrical wire. 5) Remove the TA sensor wire. 6) Remove the Drain hose. (Continue)	  

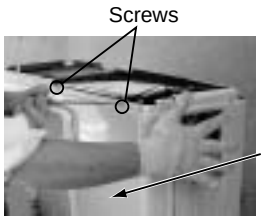
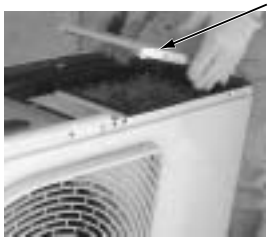
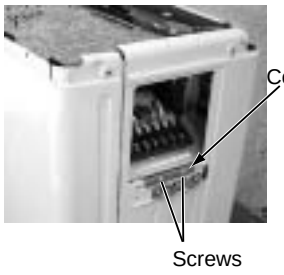
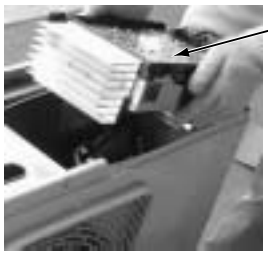
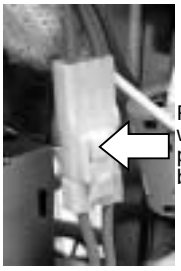
No.	Part name	Procedures	Remarks
③	Drain pan assembly	7) Remove 7 screws and remove the Drain pan assembly.	
④	Electrical parts assembly	**<How to remove the Electrical parts assembly>** 1) Remove the Air inlet grille, the Front panel and the Drain pan assembly. (①, ②, ③) 2) Remove the Terminal cover. 3) Unfasten the screw of Cord clamp and disconnect the connecting cable. 4) Remove the Connector cover and disconnect the Fan motor cords. 5) Remove the TC sensor, TCJ sensor and earth wire from Refrigeration assembly. 6) Remove the Electrical parts assembly. **NOTE** : When install the electrical parts assembly, fix the screw after the Back body is fixed.	
⑤	Refrigeration assembly	**<How to remove the Refrigeration assembly>** 1) Remove the Air inlet grille, the Front panel and the Drain pan assembly. (①, ②, ③) 2) Stop the gas at the Outdoor unit. 3) Remove 2 pipes from the Refrigeration assembly. 4) Remove the TC sensor and TCJ sensor from holder. 5) Remove the pipe holder. 6) Remove the earth wire. (Continue)	

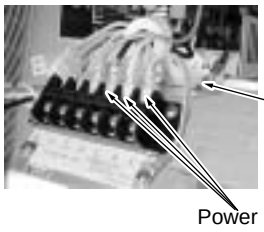
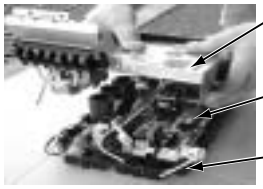
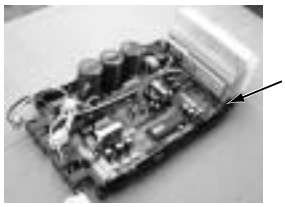
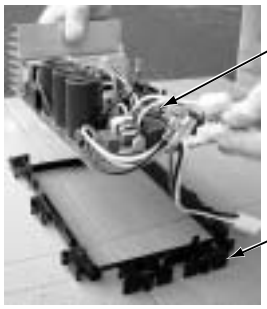
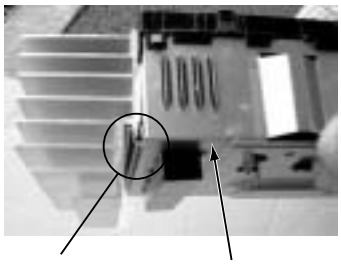
No.	Part name	Procedures	Remarks
⑤	Refrigeration assembly	7) Remove 2 screws and remove the refrigeration assembly with pushing it to right hand.	 2 Screws
⑥	Multiblade fan and Fan motor	**<How to remove the Multiblade fan and Fan motor>** 1) Remove the Air inlet grille and the Front panel. (①, ②) 2) Disconnect 2 connectors. 3) Remove the Fan covers. 4) Remove the Motor band with holding the Fan motor and then remove the Fan motor with the Multi-blade fans.	 Fan cover Motor band Motor 2 Connectors
		5) Unfasten the Set-screw and remove the Multi-blade fans.	 Multi-blade fan

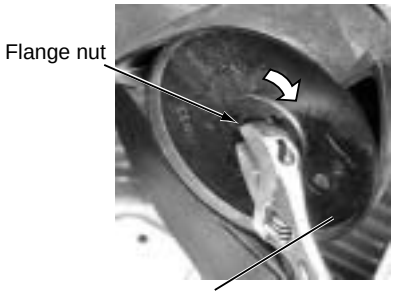
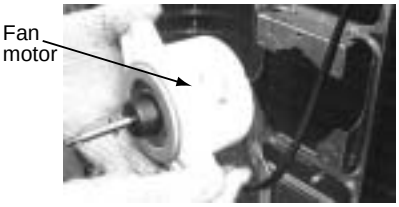
11-2. Outdoor Unit (RAV-SM560AT-E)

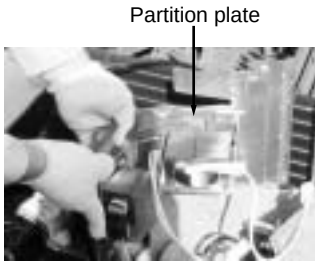
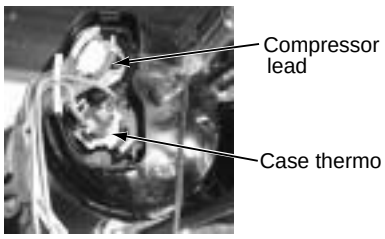
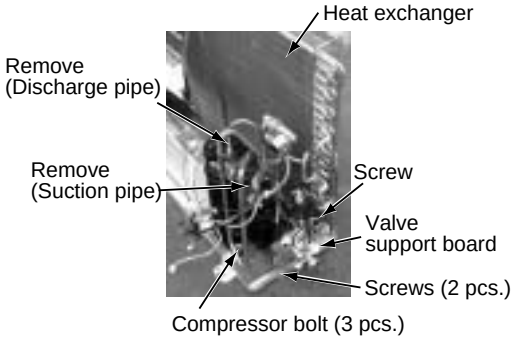
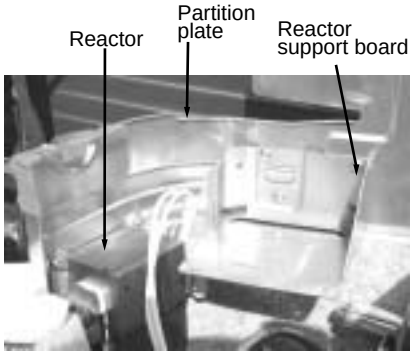
No.	Part name	Procedure	Remarks
①	Common procedure	**CAUTION** Never forget to put on the gloves at working time, otherwise an injury will be caused by the parts, etc. **1. Detachment** 1) Stop operation of the air conditioner, and turn off the main switch of the breaker for air conditioner. 2) Remove the valve cover. (ST1T Ø4 x 10L, 1 pc.) • After removing screw, remove the valve cover pulling it downward. 3) Remove wiring cover (ST1T Ø4 x 10L, 2 pcs.), and then remove connecting cable. 4) Remove the upper cabinet. (ST1T Ø4 x 10L, 2 pcs.) • After taking off screws, remove the upper cabinet pulling it upward. **2. Attachment** 1) Attach the waterproof cover. **CAUTION** Be sure to attach a waterproof cover. If it is not attached, there is a possibility that water enters inside of the outdoor unit. 2) Attach the upper cabinet. (ST1T Ø4 x 10L, 2 pcs.) • Hook the rear side of the upper cabinet to claw of the rear cabinet, and then put it on the front cabinet. 3) Perform cabling of connecting cables, and fix with cord clamp. (ST1T Ø4 x 10L 3 pcs.) 4) Attach the wiring cover. (ST1T Ø4 x 10L, 2 pcs.) 5) Attach the valve cover. (ST1T Ø4 x 10L, 1 pc.) • Insert the upper part of the upper cabinet, set hooking claw of the valve cover to the slit (at three positions) of the main body, and then attach it pushing upward.	  

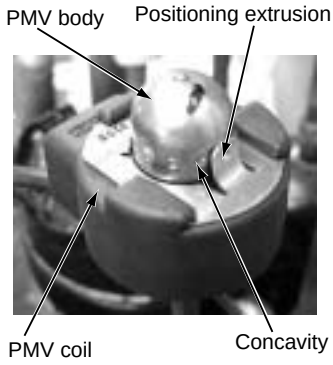
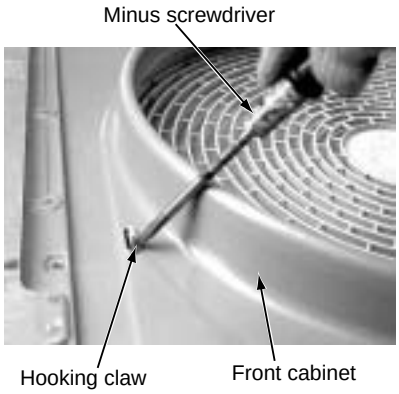
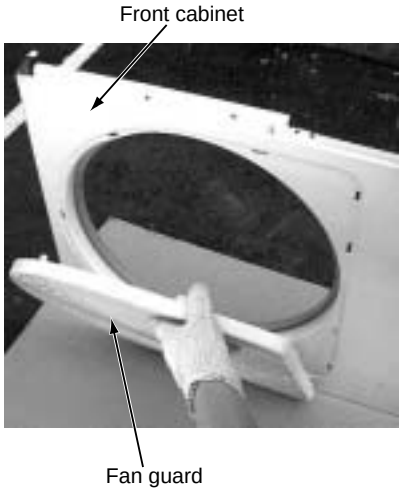
No.	Part name	Procedure	Remarks
②	Front cabinet	**1. Detachment** 1) Perform work of item 1 of ①. 2) Remove screws (ST1T Ø4 x 10L, 2 pcs.) of the front cabinet and the inverter cover. 3) Take off screws of the front cabinet and the bottom plate. (ST1T Ø4 x 10L 3 pcs.) 4) Take off screws of the front cabinet and the motor support. (ST1T Ø4 x 10L, 2 pcs.) • The left side of the front side if made to insert to the rear cabinet, so remove it pulling upward. **3. Attachment** 1) Insert hook at the left side of the front side into the rear cabinet. 2) Hook the lower part at the right side of the front to concavity of the bottom plate. Insert the hook of the rear cabinet into the slit of the front cabinet. 3) Attach the removed screws to the original positions.	   

No.	Part name	Procedure	Remarks
③	Inverter assembly	**1. Detachment** 1) Perform work of item 1 of ①. 2) Take off screws of the upper part of the front cabinet. • If removing the inverter cover under this condition, P.C. board can be checked. • If there is no space in the upper part of the upper cabinet, perform work of ②. **CAUTION** Be careful to check the inverter because high-voltage circuit is incorporated in it. 3) Perform discharging by connecting ⊕, ⊖ polarities by discharging resistance (approx. 100Ω, 40W) or plug of soldering iron to ⊕, ⊖ terminals of the C14 (printed as "CAUTION HIGH VOLTAGE") electrolytic capacitor (500µF) of P.C. board. **WARNING** The electrolytic capacitor may not normally discharge according to error contents and the voltage may remain. Therefore, be sure to discharge the capacitor. **WARNING** For discharging, never use a screwdriver and others for short-circuiting between ⊕ and ⊖ electrodes. As the electrolytic capacitor is one with a large capacity, it is very dangerous because a large electric spark will occur. 4) Take off screws (ST1T Ø4 x 10L, 2 pcs.) fixing the main body and the inverter box. 5) Remove various lead wires from the holder at upper part of the inverter box and wiring holder at right side of the terminal block. 6) Remove the lead wire from the bundled part at left side of the terminal block. 7) Pull the inverter box upward. 8) Disconnect connectors of various lead wires. **REQUIREMENT** As each connector has a lock mechanism, avoid to remove the connector by holding the lead wire, but by holding the connector.	    

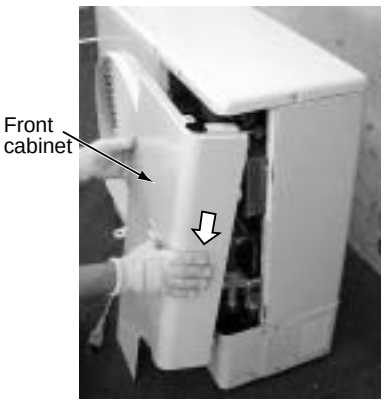
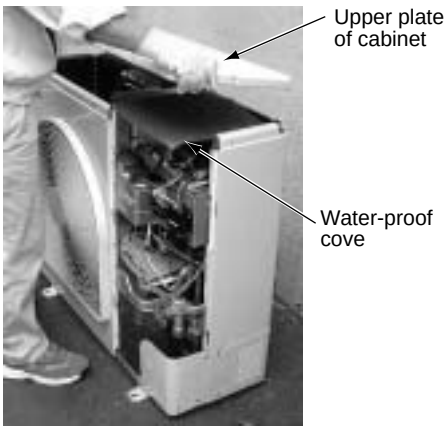
No.	Part name	Procedure	Remarks
④	Control P.C. board assembly	1) Disconnect lead wires and connectors connected from the control P.C. board assembly to other parts. 1. Lead wires • Connection with the power terminal block: 3 wires (Black, White, Orange) • Earth wire: 1 wire (Black) 2. Connectors • Connection with compressor: Remove 3P connector. • Connection with reactor: Remove the relay connectors from P07, 08 (2P, White) and P12, 13 (2P, Yellow) CN300 : Outdoor fan (3P, White) CN301 : Position detection (5P, White) CN701 : 4-way valve (3P, Yellow) CN600 : TE sensor (2P, White) CN601 : TD sensor (3P, White) CN603 : TS sensor (3P, White) CN602 : TO sensor (3P, White) CN500 : Case thermo. (2P, White) CN703 : PMV (6P, White) 2) Remove the inverter box (Metal plate). 3) Remove the control board assembly from P.C. board base. (Remove the heat sink and the control board assembly as they are screwed.) **NOTES:** 1. CN300, CN301 and CN701, etc. at the control board assembly side are connectors with locking function. Therefore, remove the connector while pushing the part indicated by an arrow mark. 2. Remove 4 hooking claws of P.C. board base, and remove upward the heat sink with hands. 4) Take off 3 screws fixing the heat sink and main control board assembly side, and replace the board with a new one. **NOTE:** When mounting a new board, check that the board is correctly set in the groove of the base holder of P.C. board base. Attach the P.C. board so that the heat sink comes securely contact with the metal sheet.	    

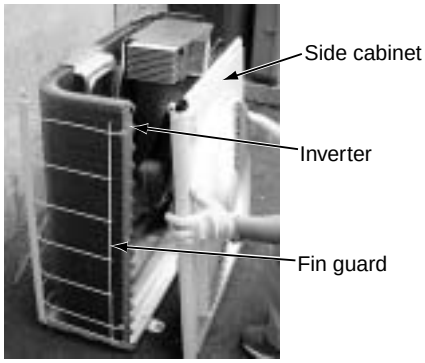
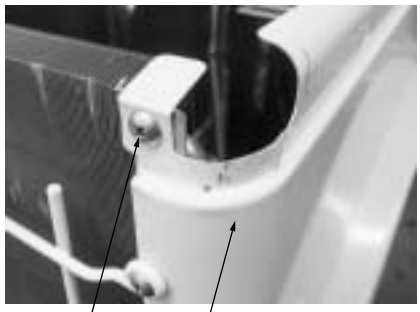
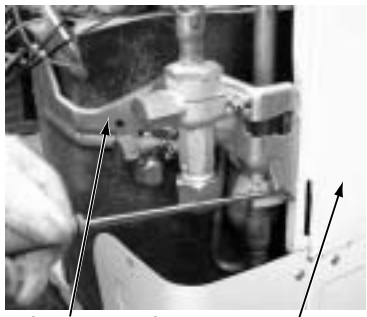
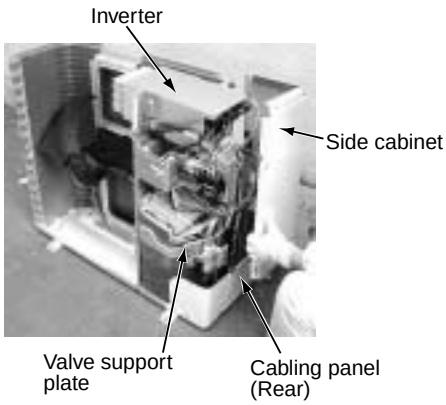
No.	Part name	Procedure	Remarks
⑤	Rear cabinet	1) Perform works of items 1 of ① and ②, ③. 2) Take off fixed screws for the bottom plate. (ST1T Ø4 x 10L, 3 pcs.) 3) Take off fixed screws for the heat exchanger. (ST1T Ø4 x 10L, 2 pcs.) 4) Take off fixed screw for the valve mounting plate. (ST1T Ø4 x 10L, 1 pc.)	
⑥	Fan motor	1) Perform works of items 1 of ① and ②. 2) Take off the flange nut fixing the fan motor and the propeller. • Turning it clockwise, the flange nut can be loosened. (To tighten the flange nut, turn counterclockwise.) 3) Remove the propeller fan. 4) Disconnect the connector for fan motor from the inverter. 5) Take off the fixing screws (3 pcs.) holding by hands so that the fan motor does not fall. **NOTE:** Tighten the flange nut with torque 4.9Nm (50kgf/cm).	 

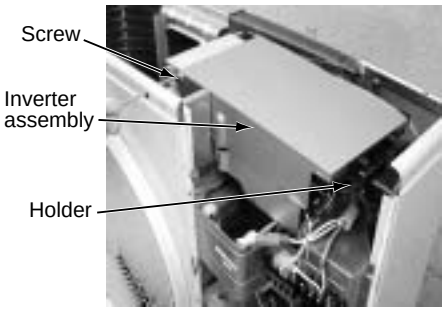
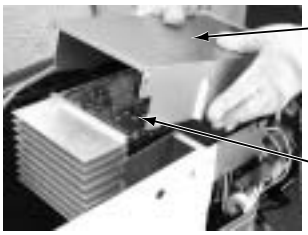
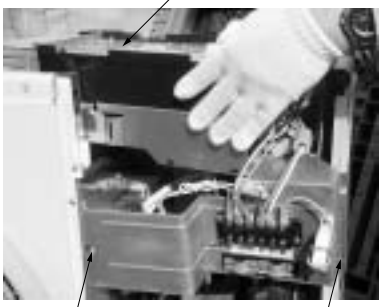
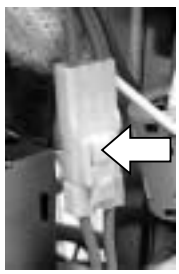
No.	Part name	Procedure	Remarks
⑦	Compressor	1) Perform works of items 1 of ① and ②, ③, ④, ⑤. 2) Discharge refrigerant gas. 3) Remove the partition plate. (ST1T Ø4 x 10L, 2 pcs.) 4) Remove the noise-insulator. 5) Remove the terminal covers of the compressor, and disconnect lead wires of the compressor and the compressor thermo assembly from the terminal. 6) Remove pipes connected to the compressor with a burner. **CAUTION** Pay attention to that flame does not involve 4-way valve or PMV. (If doing so, a malfunction may be caused.) 7) Take off the fixing screws of the bottom plate and heat exchanger. (ST1T Ø4 x 10L, 2 pcs.) 8) Take off the fixing screws of the valve clamping plate to the bottom plate. 9) Pull upward he refrigerating cycle. 10) Take off nut fixing the compressor to the bottom place. **CAUTION** When reconnecting the lead wires to the compressor terminals after replacement of the compressor, be sure to caulk the Faston terminal without loosening.	  
⑧	Reactor	1) Perform works of item 1 of ① and ③. 2) First take off two screws (ST1T Ø4 x 10L) of the reactor fixed to the reactor support. 3) Remove the reactor support from the partition plate. (ST1T Ø4 x 10L, 4 pcs.) 4) Take off two screws (ST1T Ø4 x 10L) directly attached to the partition plate.	

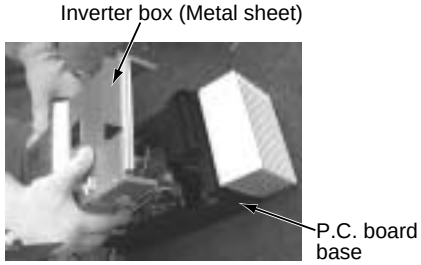
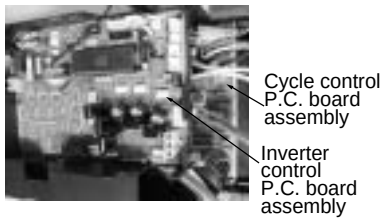
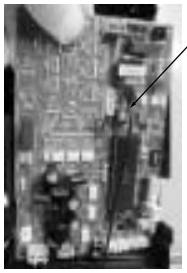
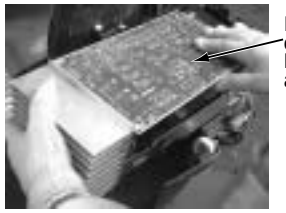
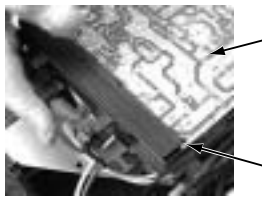
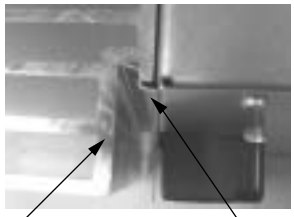
No.	Part name	Procedure	Remarks
⑨	Pulse Modulating Valve (PMV) coil	**1. Detachment** 1) Perform works of items ① and ②. 2) Release the coil from the concavity by turning it, and remove coil from the PMV. **2. Attachment** 1) Put the coil deep into the bottom position. 2) Fix the coil firmly by turning it to the concavity.	
⑩	Fan guard	**1. Detachment** 1) Perform works of items 1 of ①, and ②. 2) Remove the front cabinet, and put it down so that fan guard side directs downward. **CAUTION** Perform works on a corrugated cardboard, cloth, etc. to prevent flaw on the product. 3) Remove the hooking claws by pushing with minus screwdriver along with the arrow mark in the right figure, and remove the fan guard. **2. Attachment** 1) Insert claws of the fan guard in the hole of the front cabinet. Push the hooking claws (10 positions) with hands and then fix the claws. **CAUTION** All the attaching works have completed. Check that all the hooking claws are fixed to the specified positions.	 

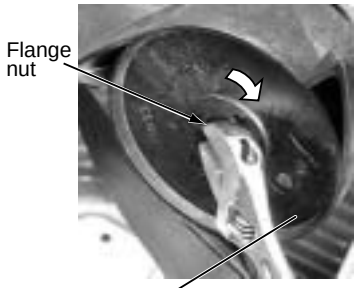
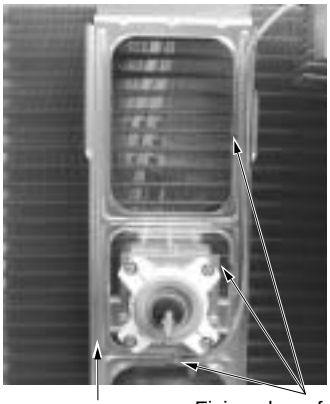
11-3. Outdoor Unit (RAV-SM800AT-E)

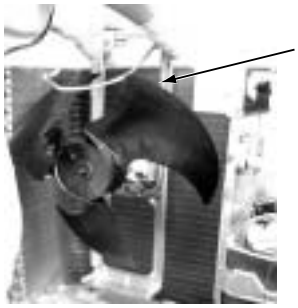
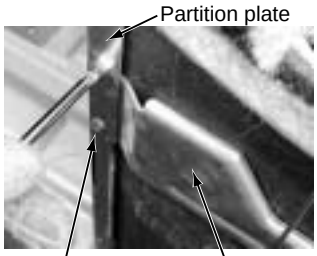
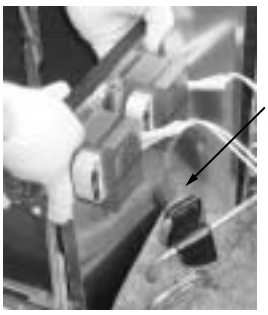
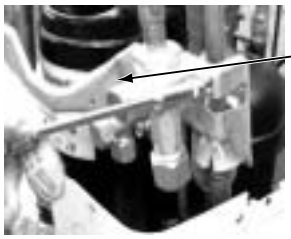
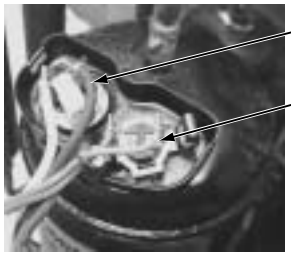
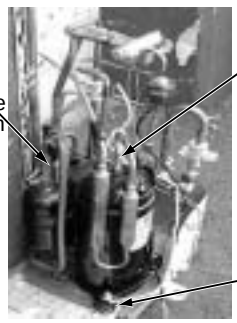
No.	Part name	Procedure	Remarks
①	Common procedure	**CAUTION** Never forget to put on the gloves at working time, otherwise an injury will be caused by the parts, etc. **1. Detachment** 1) Stop operation of the air conditioner, and also turn off switch of the breaker. 2) Remove the front panel. (ST1T Ø4 x 10L, 3 pcs.) • After taking off screws, remove the front panel by pulling it downward. 3) Disconnect the connecting cables and power cord from the terminals and cord clamp. 4) Remove the upper cabinet. (ST1T Ø4 x 10L, 6 pcs.) **2. Attachment** 1) Attach the waterproof cover. **CAUTION** Be sure to attach a waterproof cover. If it is not attached, there is a possibility that water enters inside of the outdoor unit. 2) Attach the upper cabinet. (ST1T Ø4 x 10L, 6 pcs.) 3) Connect the connecting cable and power cord at the terminal and fix them with cord clamp. **CAUTION** Using bundling band sold at a market, be sure to fix the power cables and indoor/ outdoor connecting cables along the inter-unit cable so that they do not come to contact with the compressor, valves and cables at gas side, and the discharge pipe. 4) Attach the front cabinet. (ST1T Ø4 x 10L, 3 pcs.)	 

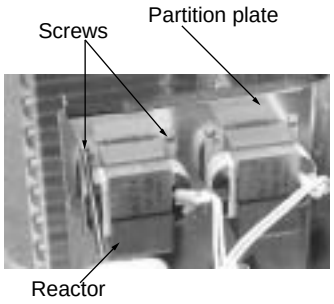
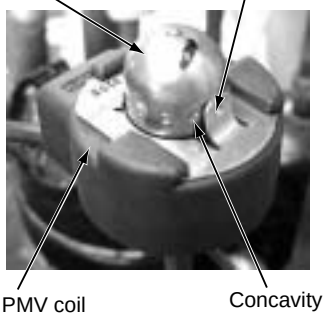
No.	Part name	Procedure	Remarks
②	Discharge port cabinet	**1. Detachment** 1) Perform work of item 1 of ①. 2) Take off screws (ST1T Ø4 x 10L, 3 pcs.) of discharge port cabinet for the partition plate. 3) Take off screws (ST1T Ø4 x 10L, 2 pcs.) of discharge port cabinet for the bottom plate. 4) Take off screw (ST1T Ø4 x 10L, 1 pc.) of discharge port cabinet for the heat exchanger. 5) Take off screws (ST1T Ø4 x 10L, 2 pcs.) of discharge port cabinet for the fin guard. **2. Attachment** 1) Put the upper left side of the discharge port cabinet on the end plate of the heat exchanger, and then fix it with screw. (ST1T Ø4 x 10L, 1 pc.) 2) Attach the removed screws to the original positions.	 
③	Side cabinet	1) Perform work of item 1 of ①. 2) Remove screw fixing the inverter and the side cabinet. (ST1T Ø4 x 10, 1 pc.) 3) Remove screws of the side cabinet and the valve support plate. (ST1T Ø4 x 10, 2 pcs.) 4) Remove screw of the side cabinet and the cabling panel (Rear). (ST1T Ø4 x 10, 1 pc.) 5) Remove screw of the side cabinet and the bottom plate. (ST1T Ø4 x 10, 1 pc.) 6) Remove screw of the side cabinet and the fin guard (Heat exchanger). (ST1T Ø4 x 10, 2 pcs.)	 

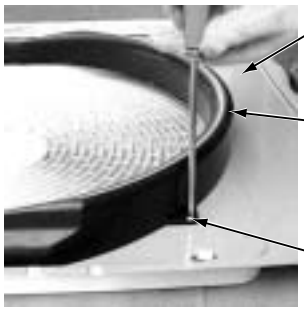
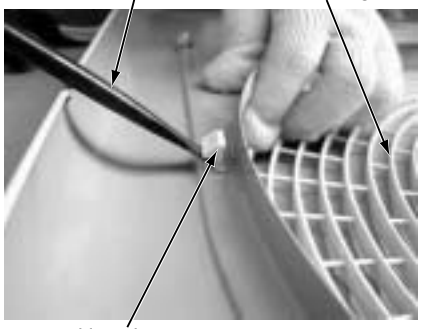
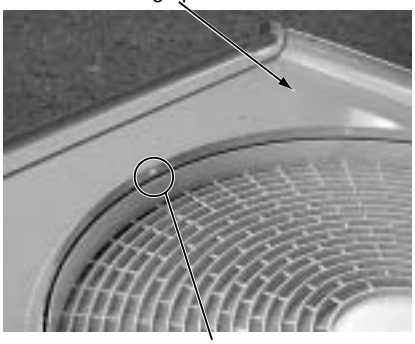
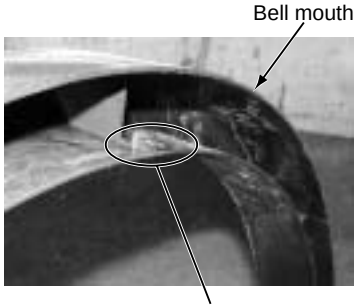
No.	Part name	Procedure	Remarks
④	Inverter assembly	1) Perform works of items of 1) to 5) of ①. 2) Take off screw (ST1T Ø4 x 10L, 1 pc.) of the upper left part of the inverter cover. • If removing the inverter cover under this condition, P.C. board can be checked. • If there is no space in the upper part of the upper cabinet, perform works of items 6) to 7) of (1) and remove the partition fixing plate. (ST1T Ø4 x 10L, 1 pc.) **CAUTION** Be careful to check the inverter because high-voltage circuit is incorporated in it. 3) Perform discharging by connecting the discharging resistance (approx. 100Ω, 40W) or plug of soldering iron to ⊕, ⊖ terminals of the C10 too 13 (printed as "CAUTION HIGH VOLTAGE") electrolytic capacitor (760µF) of P.C. board. **WARNING** The electrolytic capacitor may not normally discharge according to error contents and the voltage may remain. Therefore, be sure to discharge the capacitor. **WARNING** For discharging, never use a screwdriver and others for short-circuiting between ⊕ and ⊖ electrodes. As the electrolytic capacitor is one with a large capacity, it is very dangerous because a large electric spark will occur. 4) Remove various lead wires from the holder at upper part of the inverter box. 5) Remove the hook for the partition plate (lower left side). 6) Remove the hook for the side cabinet (lower left side) and the screw, and lift up the inverter assembly upward. (ST1T Ø4 x 10L, 1 pc.) In this time, cut off the band bundling each lead wire. 7) Disconnect connectors of various lead wires. **REQUIREMENT** As each connector has a lock mechanism, avoid to remove the connector by holding the lead wire, but by holding the connector.	   

No.	Part name	Procedure	Remarks
⑤	Control P.C. board assembly	1) Remove the inverter box from P.C. board base. 2) Disconnect lead wires and connectors connected from the control P.C. board assembly to other parts. 1. Lead wires: With the power terminal block: 2 pcs. (Single phase) (Red, White) With the compressor: 3 pcs. (Red, White, Black) 2. Connectors CN301 : Outdoor fan (3P, White) ***Note 1)** CN300 : Position detection (5P, White) CN700 : 4-way valve (3P, Yellow) ***Note 1)** CN702 : PMV coil (6P, White) CN600 : TD sensor (3P, White) CN605 : TS sensor (3P, White) ***Note 1)** CN604 : TE sensor (2P, White) ***Note 1)** CN601 : TO sensor (2P, White) CN02 : Indoor/Outdoor connecting terminal block (2P, Black) CN500 : Case thermo (2P, White) ***Note 1)** CN14, CN15 : Reactor (3P, Relay connector, Blue) ***Note 1)** ***Note 1)** Remove the connector while releasing locking of the housing. 3) Remove the control P.C. board assembly from P.C. board base. (Remove the heat sink and the inverter control P.C. board assembly as they are screwed.) **Note 2)** Remove the heat sink upward by taking off two claws of P.C. base and holding the heat sink. 4) Take off three screws fixing the heat sink to the control P.C. board assembly. 5) Mount a new control P.C. board assembly. **Note 3)** When mounting a new board, check that it is correctly set in the groove of the base holder of P.C. board base.	     

No.	Part name	Procedure	Remarks
⑥	Fan motor	1) Perform works of items 1) to 5), 7) of ① 2) Remove the flange nut fixing the fan motor and the propeller fan. • Loosen the flange nut by turning clockwise. (To tighten the flange nut, turn it counterclockwise.) 3) Remove the propeller fan. 4) Remove the lead wire from the hook fixing the fan motor lead wires on the motor base. (Three positions) 5) Disconnect the connector for fan motor from the inverter. 6) Take off the fixing screws (4 pcs.) while holding by hands so that the fan motor does not fall. **NOTE :** Tighten the flange nut with torque 9.8Nm (100kgf/cm).	 

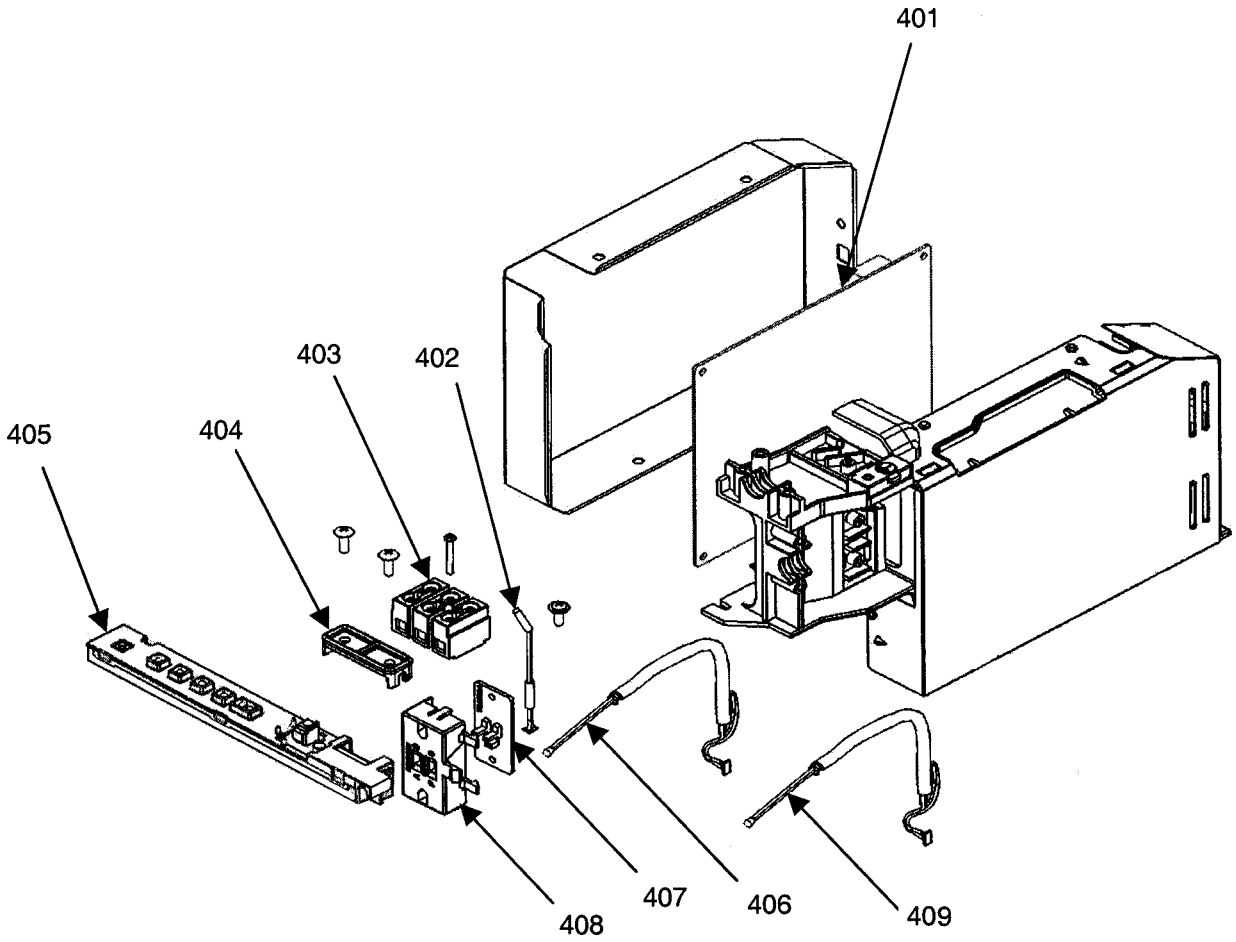
No.	Part name	Procedure	Remarks
⑥	Compressor	1) Perform works of items ①, ②, ③, ④, and ⑤. 2) Evacuate refrigerant gas. 3) Disconnect the connector for fan motor from the inverter. 4) Take off screws fixing the motor base to the bottom plate. (ST1T Ø4 x 10L, 2 pcs.) 5) Remove the motor base together with the fan motor and the propeller fan. 6) Take off screws fixing the partition plate to the valve support plate. (ST1T Ø4 x 10L, 2 pcs.) 7) Remove the valve support plate. (M6 x 4 pcs.) 8) Take off screws of the partition plate and the bottom plate. (ST1T Ø4 x 10L, 2 pcs.) 9) Take off screws of the partition plate and the heat exchanger. (ST1T Ø4 x 10L, 2 pcs.) 10) Remove the noise-insulator. 11) Remove the terminal covers of the compressor, and disconnect lead wires of the compressor and the compressor thermo assembly from the terminal. 12) Remove pipes connected to the compressor with a burner. **CAUTION** Pay attention to that flame does not involve 4-way valve or PMV. (If doing so, a malfunction may be caused.) 13) Pull the refrigerating cycle upward. 14) Take off nut fixing the compressor on the bottom plate. (3 pcs.) 15) Pull the compressor toward you. **CAUTION** When reconnecting the lead wires to the compressor terminals after replacement of the compressor, be sure to caulk the Faston terminal without loosening.	     

No.	Part name	Procedure	Remarks
⑧	Reactor	1) Perform works of items 1 of ① and ④. 2) Take off screws fixing the reactor. (Ø4 x 10L , 2 pcs. per one reactor. An outdoor unit has two reactors on the partition plate.)	
⑨	Pulse Modulating Valve (PMV) coil	**1. Detachment** 1) Perform works of items 1 of ① and ③. 2) Remove the coil from PMV body while pulling it upward. **2. Attachment** 1) Match the positioning extrusion of the coil surely to the concavity of PMV body to fix it.	

No.	Part name	Procedure	Remarks
⑩	Fan guard	**1. Detachment** 1) Perform works of items 1 of ① and ④. 2) Remove the air flow cabinet, and put it down so that the fan guard side directs downward. **Perform work on a corrugated cardboard, cloth, etc. to prevent flaw to the product.** 3) Take off screws fixing the bell mouth. (ST1Tf4 x 10L, 2 pcs.) 4) Remove the bell mouth. 5) Remove the hooking claws by pushing with minus screwdriver along with the arrow mark as shown in right figure. **2. Attachment** 1) Insert claw of the fan guard in hole of the discharge panel. Push the hooking claws (5 positions) with hands and fix the claws. **After all the attachment works are completed, check that all the hooking claws are fixed to the specified positions.** 2) Mount the bell mouth by hooking three claws at upper side of the bell mouth in the slits on the discharge cabinet. 3) After attachment, fix the bell mouth with screws. (ST1Tf4 x 10L, 2 pcs.)	   

12. EXPLODED VIEWS AND PARTS LIST

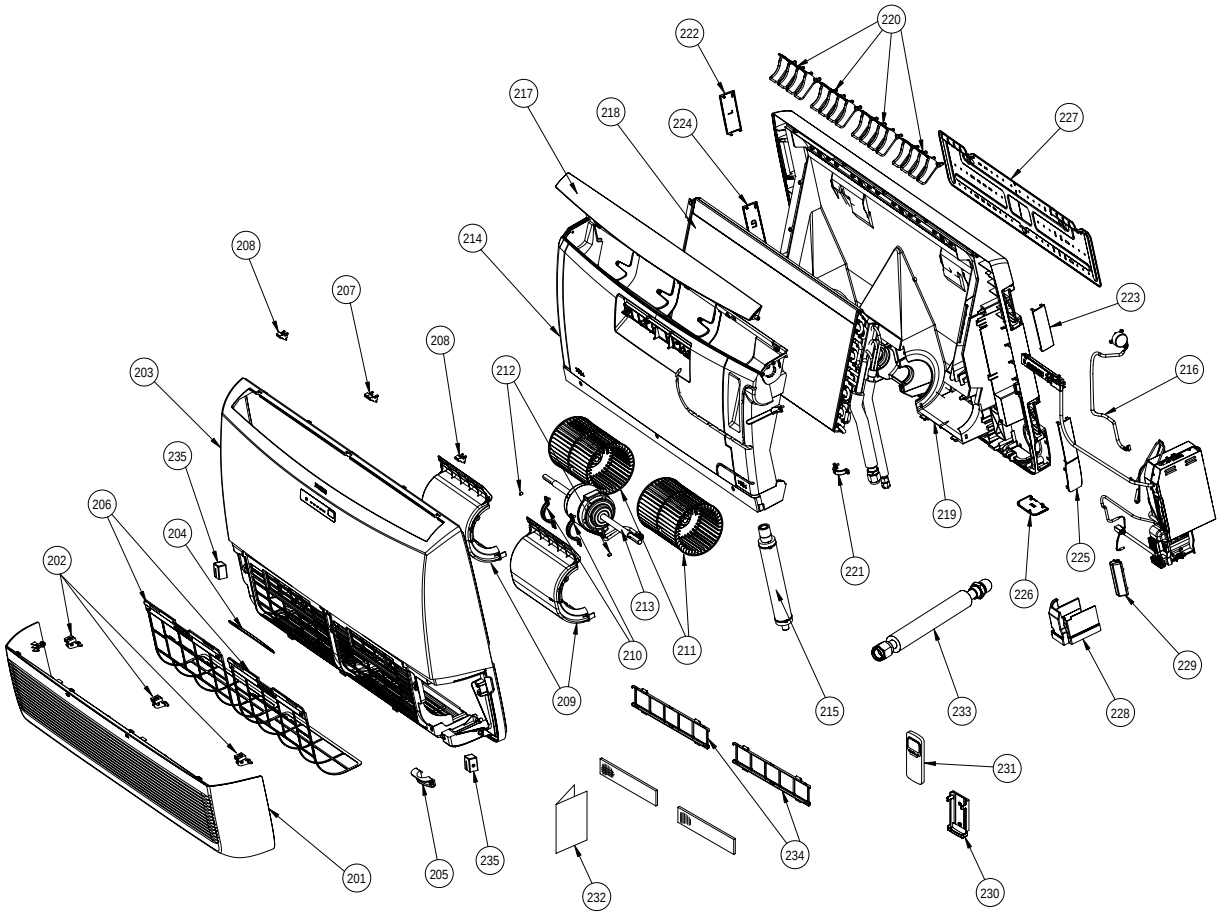
12-1. Indoor Unit (E-Parts Assy)



Location No.	Part No.	Description
401	43T69348	PC Board (RAV-SM560XT-E)
401	43T69349	PC Board (RAV-SM800XT-E)
402	43T50004	Temperature sensor
403	43T60002	Terminal Block, 3P
404	43T62003	Cord clamp
405	43T69315	Display unit

Location No.	Part No.	Description
406	43T50302	Temperature sensor
407	43T69348	PC Board (RAV-SM560XT-E)
407	43T69349	PC Board (RAV-SM800XT-E)
408	43T08349	Switch cover
409	43T50306	Temperature Sensor (TCJ Sensor)

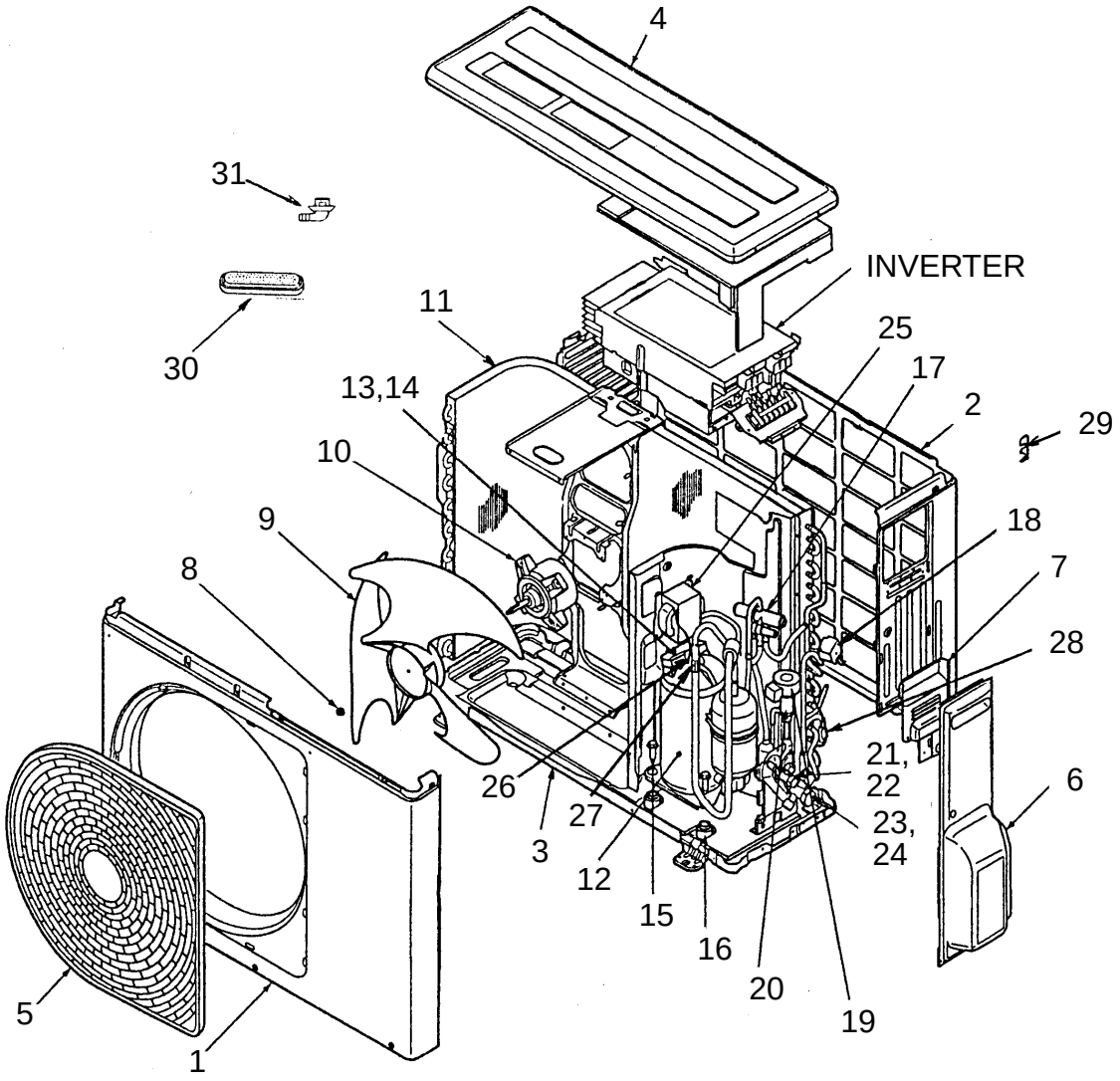
12-2. Indoor Unit



Location No.	Part No.	Description
201	43T09312	Air Inlet Grille
202	43T00357	Panel Arm Assy
203	43T00358	Front Panel Assy
204	43T01004	Mark
205	43T79303	Drain Band
206	43T80302	Air Filter
207	43T00359	Cap Screw C
208	43T00360	Cap Screw LR
209	43T20303	Fan Cover
210	43T20304	Motor Band Assy
211	43T20305	Multiblade Fan
212	43T19309	Screw Set (D-T)
213	43T21325	Fan Motor
214	43T72301	Drain Pan Assy
215	43T79304	Drain Hose Assy
216	43T19303	Louver Motor Assy
217	43T09313	Horizontal Louver
218	43T44331	Refrigeration Assy, ∅12.7 (SM560XT-E)
218	43T44332	Refrigeration Assy, ∅15.9 (SM800XT-E)

Location No.	Part No.	Description
219	43T03303	Back Body Assy
220	43T09314	Vertical Louver
221	43T49303	Pipe Holder
222	43T19304	Cover Body L
223	43T19305	Cover Body R
224	43T19306	Cover Body LD
225	43T19307	Bush Body R
226	43T19308	Bush Body D
227	43T82302	Installation Plate
228	43T60314	Terminal Cover
229	43T62303	Connector Cover
230	43T83003	Remote control Holder
231	43T69309	Wireless Remote control
232	43T85399	Owner's Manual
233	43T49304	Flexible pipe, ∅12.7 Assy (SM560XT-E)
233	43T49310	Flexible pipe, ∅15.9 Assy (SM800XT-E)
234	43T80003	Filter Frame
235	43T00365	Grille Stopper Assy

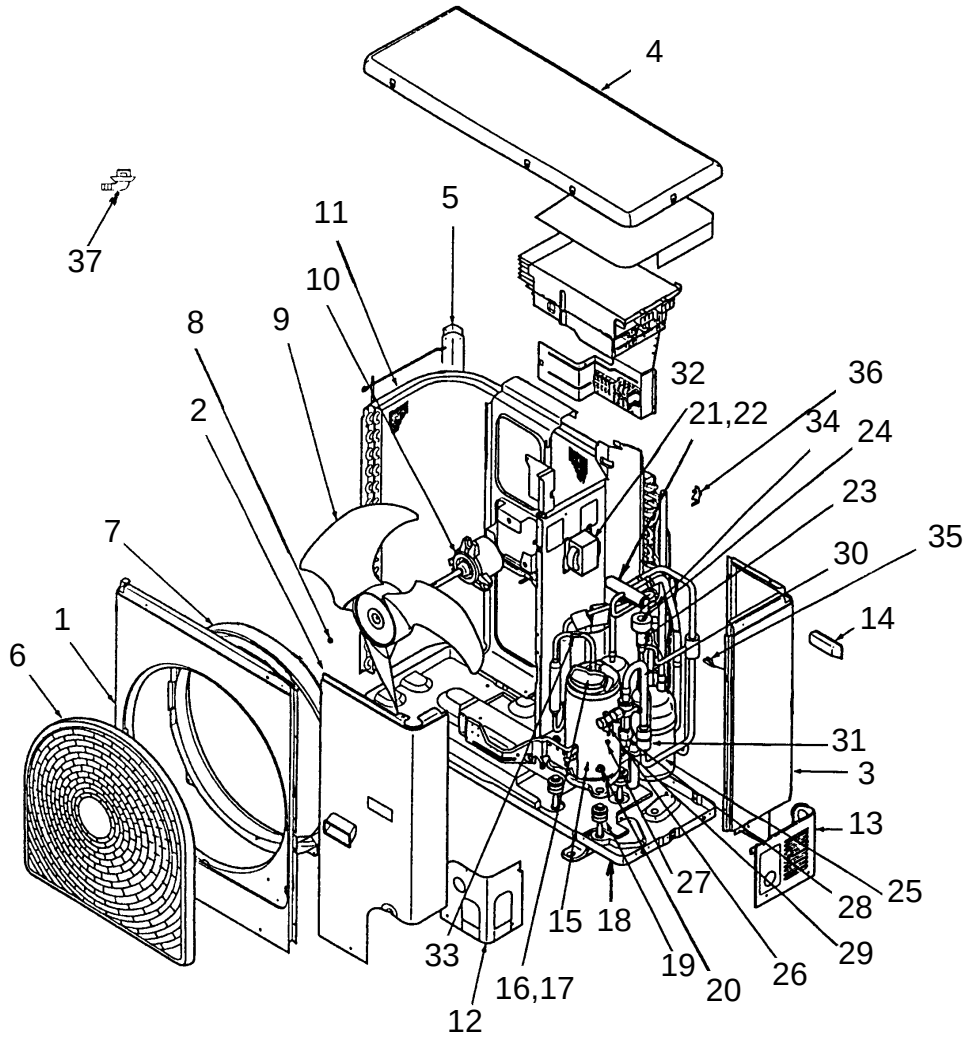
12-3. Outdoor Unit (RAV-SM560AT-E)



Location No.	Part No.	Description
01	43105037	Cabinet, Front, PCM
02	43100239	Cabinet, Back, PCM
03	43042468	Base, Ass'y
04	43005508	Cabinet, UP, PCM
05	43119460	Guard, Fan, PP
06	43119448	Cover, Packed, Valve
07	43062230	Cover, Wiring, Ass'y
08	43047667	Nut, Flange
09	43020329	Fan, Propeller, PJ421
10	4302C033	Motor, Fan, ICF-140-43-1
11	4314G128	Condenser, Ass'y
12	43041609	Compressor, DA130A1F-23F
13	43050407	Thermostat, Bimetal
14	43063317	Holder, Thermostat
15	43097206	Bolt, Compressor, M6
16	43049749	Rubber, Cushion
17	43046363	Valve, 4-WAY, VT7101D

Location No.	Part No.	Description
18	43146617	Solenoid, Coil, LB64045
19	43046385	Valve, Pulse, Modulating, SKV-18D26
20	43046394	Coil, PMV, DKV-MOZS744BO
21	43046392	Valve, Packed, 6.35, AO
22	43147195	Bonnet, 1/2 IN
23	43046393	Valve, Packed, 12.7, HKU-R410A-H4
24	43147196	Bonnet, 1/4 IN, 6.4 CU
25	43055521	Reactor, CH-57
26	43063321	Holder, Sensor, 4-8, 9.52
27	43063322	Holder, Sensor, 6-11.4, 12.7
28	43063325	Holder, Sensor, 6-6.35, 8
29	43063332	Holder, Sensor
30	43089160	Cap, Waterproof
31	43032441	Nipple, Drain

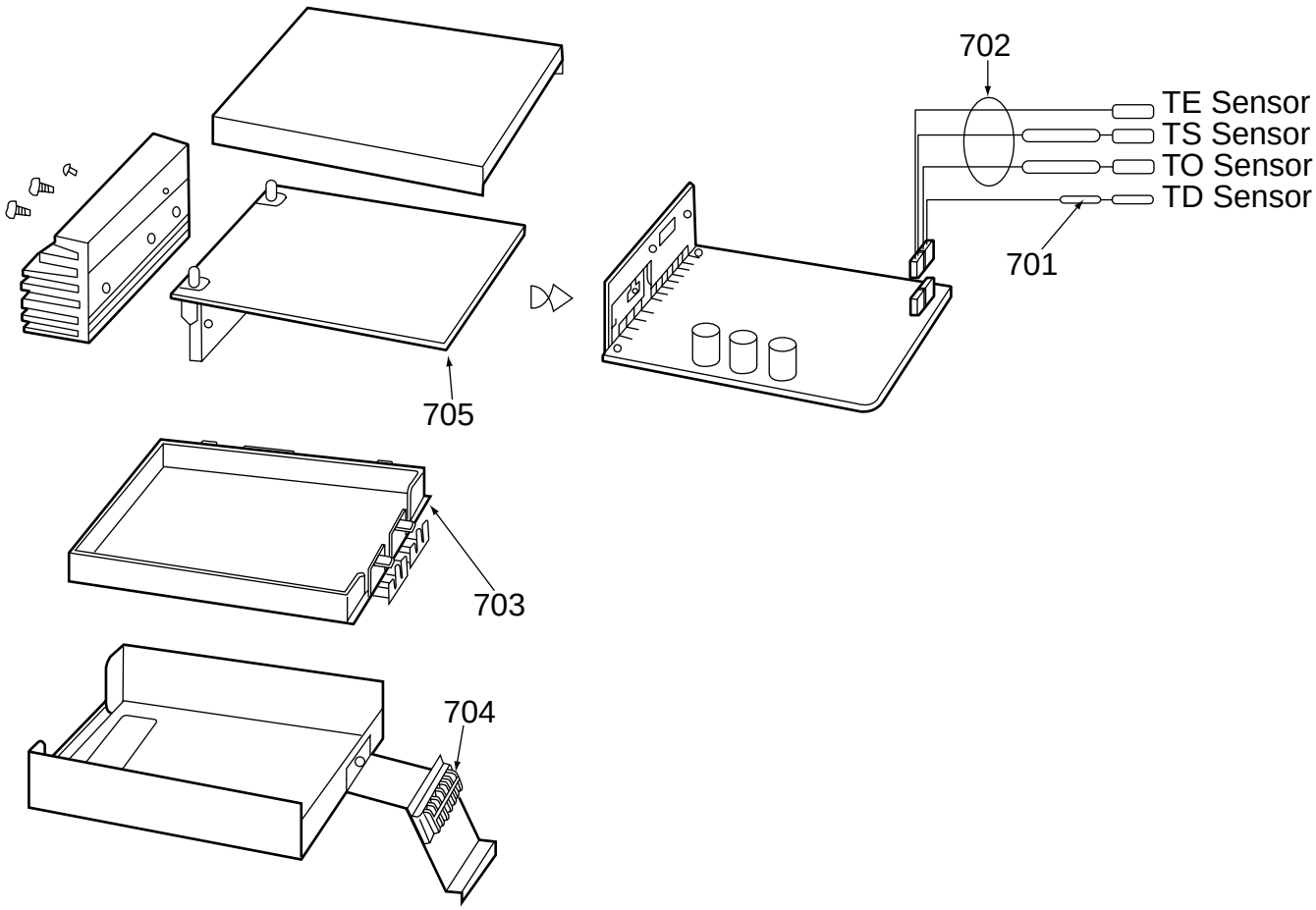
12-4. Outdoor Unit (RAV-SM800AT-E)



Location No.	Part No.	Description
01	43191634	Cabinet, Air Outled
02	43191636	Cabinet, Front, Ass'y
03	43191635	Cabinet, Side, Ass'y
04	43191637	Panel, Upper
05	43005489	Guard, Fin
06	43191630	Guard, Fan, PP-K
07	43122065	Bell Mouth, Plastic
08	43047667	Nut, Flange
09	43120123	Fan, Propeller, PJ491, AS-G
10	43121693	Motor, Fan, ICF-140-63-1
11	4314G117	Condenser, Ass'y
12	43191515	Panel, Front, Piping
13	43191605	Panel, Back, Piping
14	43119390	Hanger
15	43041772	Compressor Ass'y
16	43050407	Thermostat, Bimetal
17	43063317	Holder, Thermostat
18	43005482	Base Ass'y
19	43049739	Cushion, Rubber

Location No.	Part No.	Description
20	43097204	Nut
21	43046344	Valve, 4-WAY, CHV-0213
22	43046348	Coil, Solenoid, VHV-01A150A1
23	43046385	Valve, Pulse, Modulating, SKV-18D26
24	43046386	Coil, PMV, DKV-MO25743BO
25	43048066	Accumulator Ass'y
26	43146584	Valve, Packed, 9.52DIA, HKT9.52
27	43047401	Bonnet, 3/8 IN, 9.52 CU
28	43146613	Valve, Ball, B5/8F
29	43195029	Bonnet
30	43148169	Strainer
31	43148176	Strainer
32	43058266	Reactor, CH-47-Z-K
33	43063321	Holder, Sensor, 4-8, 9.52
34	43063322	Holder, Sensor, 6-11.4, 12.7
35	43063325	Holder, Sensor, 6-6.35, 8
36	43063332	Holder, Sensor
37	43032441	Nipple, Drain

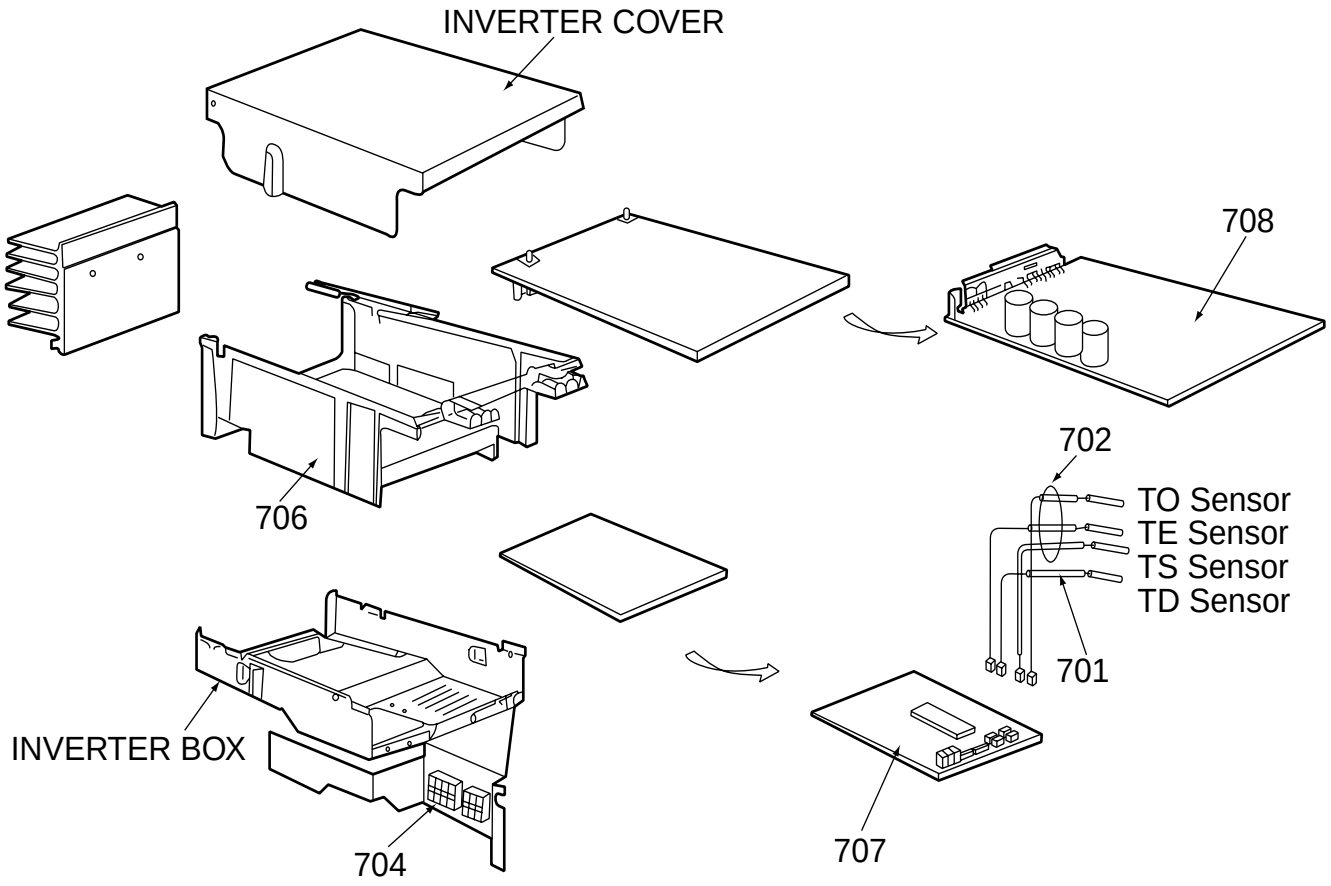
12-5. Outdoor Unit (Inverter Assy, RAV-SM560AT-E)



Location No.	Part No.	Description
701	43050334	Sensor, TD (F4), TD Sensor
702	43050382	Sensor, TC (F6), TC Sensor
703	43062228	Base, P.C. Board, ABS

Location No.	Part No.	Description
704	43160469	Terminal Block, 6P, AC250V, 20A
705	4316V182	P.C. Board Ass'y, MCC-813

12-6. Outdoor Unit (Inverter Assy, RAV-SM800AT-E)



Location No.	Part No.	Description
701	43050334	Sensor, TD (F4), TD Sensor
702	43050382	Sensor, TC (F6), TC Sensor
704	43160469	Terminal Block, 6P, AC250V, 20A

Location No.	Part No.	Description
706	43162042	Base, P.C. Board, ABS
707	4316V183	P.C. Board Ass'y, CDB, MCC-1398
708	4316V184	P.C. Board Ass'y, IPDU, MCC-1359

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